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THE TEMPLES OF NIKKO.

"THERE is no necessity at present of asking space for a complete narrative of my sojourn in Japan," says M. Henri Turot, in Le Monde Illustré. "I shall speak here only of one of the finest excursions that tourists make in that country, viz., a visit to the temples of Nikko. It takes but from seven to eight hours to go from Yokohama to Nikko by railroad.

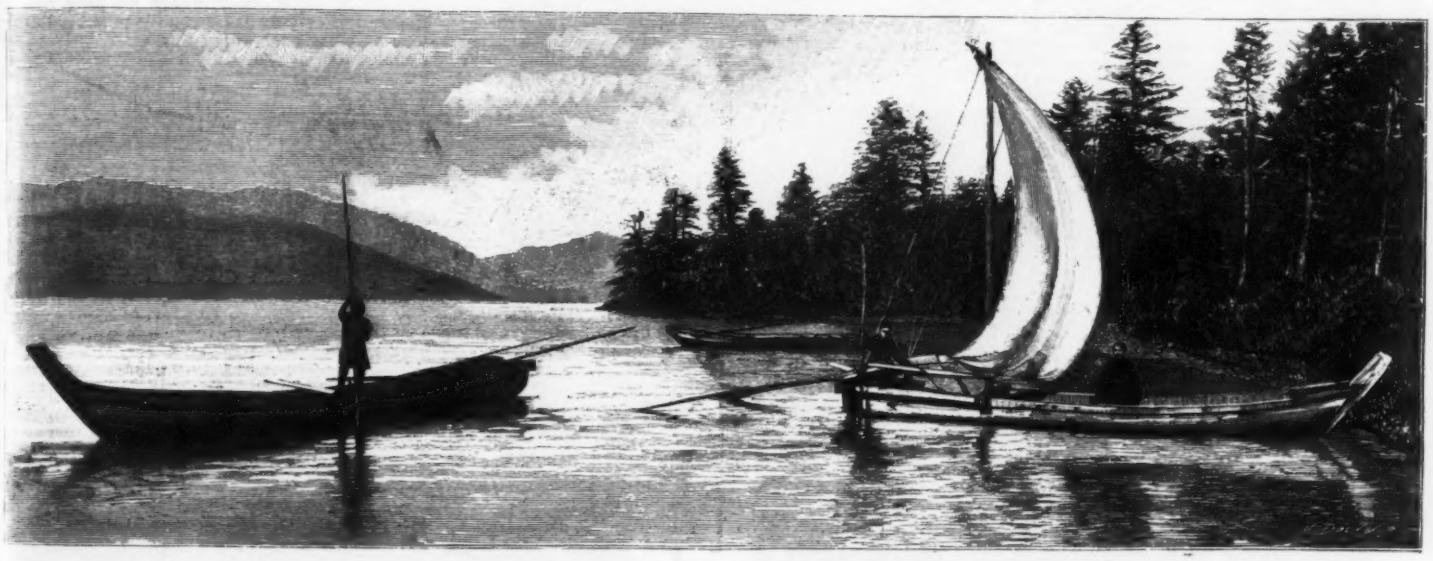
"Immediately upon his arrival the traveler is struck by the charm of this little town, which is admirably situated in a verdant valley overlooked by beautiful wooded hills.

"At the extremity of the main street a bridge, thrown over a torrent that flows in tumultuous waves, leads to the sacred inclosure in which stand the most venerated temples of Japan, and to which, at certain epochs, pilgrims come in crowds.

"The place is delightful. I cannot describe the exquisite tranquility of the large avenues bordered with gigantic cryptomerias, which erect their tall summits toward heaven.

"All is calm and silent, and the steps of the pedestrian alone disturb the repose of these imposing avenues, where the birds themselves dare not warble.

"It would require volumes to give a complete description of the temples of Nikko, and all that I desire is to



AT THE EDGE OF LAKE TRUZENDJI.

THE SACRED BRIDGE.

VIEWS IN NIKKO.

take a rapid walk with the reader through those exquisite shades where here and there stand temples or pagodas of a somewhat artless architecture, but decorated with an incomparable wealth of color and a wonderful profusion of strange and finely executed sculptures.

"Here we see a five-story pagoda painted red, rising harmoniously and embellished with odd figures and elegant carvings. Farther along stands the temple of Toshogu, the door of which is flanked by two gilded troughs entirely covered with sacred sculptures. In the court are superb colossal lanterns of iron, bronze or stone, all of which recall the memory of some respected daimios.

"Let us now climb this monumental stairway that zigzags under the forest of cryptomerias and ascends the slope of the mountain, and we shall soon reach the tomb of Tegas, a famous dhogun, who has been called by his modern admirers the Napoleon of Japan.

"If we enter the temples we shall be astonished at the inestimable wealth accumulated therein, and at the fantastic paintings, gold lacquers, sculptured panels and exquisitely decorated ceilings. Hours may be passed thus in the sacred inclosure of the temples of Nikko.

"Then, when one is satiated with admiring the work of man, he can rest himself by enjoying the charm of the environs of Nikko. Picturesque torrents meander in cool and shady valleys; on every side are found imposing cascades that fall from rock to rock; and one has only the trouble of choice between the multitude of paths that ascend the mountain, and all of which offer the tourist delightful excursions.

"The road that leads to Lake Truzendji is charming, and the points of view that are discovered at every turn quickly make one oblivious of the fatigue of ascending a road that is kept in repair in a very problematic manner. And then the lake is exquisite, surrounded as it is by high mountains and reflecting in its blue waters the image of the high trees on its banks.

"It is here that I passed the pleasantest moments of my stay in Japan, for solitude was here perfect. Japan without the Japanese (!) would be a charming country."

THE GREAT STAIRWAY.

THE FIVE-STORY PAGODA.

THE TEMPLES OF NIKKO.

FOSSILS AND THEIR TEACHINGS.*

THE original word fossil means something dug out, and in its broad definition embraces ordinary animals buried in ash-heaps, from those types only recently become extinct to those most remote in geological history. A horse that has been lying around for a period of a few hundred years might properly be considered a fossil; yet we should be considered as out of the way in describing a horse lying around a field five or ten years, as a fossil. Between five and ten years and the larger period, however, there is no established line of demarcation. If we should find a skeleton that is slightly altered in its composition, of one of the vertebrate animals of to-day, we should say it has become fossilized—changed; but there are an endless number of fossils extending back to old periods of time, showing no perceptible change from the same animal living now. Change, therefore, is not absolutely a criterion to distinguish a fossil from the present type. In order to bridge over the difficulty—to connect the best, or truest, fossils with animals that are recent, or not best—we have a sub-fossil as a sort of intermediate or connecting type.

There are many ways in which fossils occur in nature. One of these may be said to be a type of the actual organism itself, or a part of it. We have in this fish, for instance, bone for bone, the entire skeleton, with also the intermediate objects; and, therefore, we say that we have the fossil of this fish bedded in the rock. In this case we have the thing itself; so again, in this part of the jawbone of a mastodon, the actual substances themselves, unchanged, and yet the specimen may be 15,000, 20,000 or 50,000 years old—surely not less than a few thousand; yet in other cases the fossil means not only the actual specimen but any impression it may have made in the rock. If this tooth were lying in the clay bed, naturally the distinct form of the tooth would be indicated on that clay bed on the removal of the specimen. We should then have a specimen ordinarily named the "cast of a fossil"; but the cast is considered just as good a fossil as the specimen itself. If you found what had been the two valves of a clam shell, and the space between became filled with clay, on the removal of the shell by disintegration you would have a mold contained within the two valves that would be a true fossil, designated as a mold of the original specimen, yet recognized as a fossil; therefore, we have the original thing, the cast, and the mold as three forms of fossil.

There is another type—not a true fossil, but one of the group of the incrustations, as in this incrustation of carbonate of lime over a mouse from a lake near Rome. The mouse occurs in that region; the stream has lime in solution which is deposited as a coat over it, and you have an incrusted mouse; but, while this is ordinarily considered to be a fossil, yet the fossil object has nothing whatever to do with that incrustation, as it is merely a superficial coat that belongs absolutely to our own time. This ordinary bird's nest with the eggs in it has been dipped into an incrusting water, with carbonate of lime in solution; the material has been dropped over it, and here you have the specimen which may be 15,000 years old. The fish just mentioned has a framework of thousands of pieces of small bone; yet each and every piece entering into the construction of the skeleton is preserved in this fossil in its entirety, the specimen being from 50,000 to 75,000 years old—very much older than the mastodon's tooth. This group of small fish—a shoal of young herring—is probably not less than half a million years old at the outside limit; yet when we look over the single block of rock and find not less than thirty or forty individual fishes, each one showing the bone construction, not only of the main body, but also in the fins, and likewise the preservation of the black specks indicating the eye—representing, in fact, the fossils of the eye—we have brought before us a picture of that remarkable preservation we often find in fossil remains.

Among the older types we have a dragon-fly perfectly preserved in this rock mass, about two inches in length—the body all drawn out, the head above it and the wings spread out on two sides—not less than several million years old; yet this specimen has passed through all the vicissitudes that distinguish the formation of the earth, and still is preserved. How is it possible? According to any law of chances, a certain number must be preserved; and it so happens that this specimen is one of those. But, apart from this hundreds of millions, doubtless, have been destroyed. Here is fossil sepia, or India ink—a fossilized ink-bag of the type of cuttle-fish that lived far back in geological history, and had inside, as an organ of defense, a secretion of black fluid enabling it, when attacked, to throw out a cloud of black ink, under cover of which it escaped. We have in this specimen the full length of ink-bag with the black substance of the ink solidly fossilized and which, when properly treated, can be made to yield excellent India ink to-day—very nearly as good as the best, yet coming from an animal buried in the rock deposit millions of years ago.

Imbedded in this other rock are hundreds of a small shell about one-third inch long, representing as nearly as may be found the oldest organism with which we are acquainted, and closely related to the limulus, with a long projection resembling a small tongue. This specimen, certainly not less than 40,000,000 to 50,000,000 years old, has retained its shell practically unbroken through all this period of time. Here alongside of it, on the other hand, is a fossil of some newer date, known to geologists as a trilobite, closely related to some of the king-crabs living to-day, which has had itself broken up in the process of alteration through which the rocks have passed. Extending back through the dragon-fly's period of time there are a number of slabs extant where we have actually the impression of jelly-fishes clearly preserved from millions of years ago, where that great body of jelly became stranded upon either a common shore or a sandy shale, left its impress distinctly on top of that shale; and over it was laid down a greater or less deposit of sand or clay, and through all that long period of time the impression has lasted; and yet in by far the greater number of cases such an impression is effaced by the slightest disturbance of wind or water. In some instances color markings have extended back to at least a million years or more, as has been safely proven. In an exploration a few years ago along the Florida coast the markings were shown in a number of fossil shells I came upon—the real tints in a few specimens almost as distinct as we find them to-day; yet those animals had been extinct thousands of years.

The preservation of soft parts of animals is of rather rare occurrence. The decomposition of animal tissue is a rapid operation, and while we may have the casts or impressions of the soft parts, it is only probably exceptional that we have those parts actually preserved; and when they do so occur, it is more generally in the later periods. The numerous instances that are cited of the fleshy parts of the human body found in a fossilized condition represent not fossilization at all, but a deposit of adipocere. No part of the fleshy remains of man or any of the larger animals has been found, except in recent deposits. In specimens of mammoth (particularly in those at St. Petersburg), the great carcasses have been so well preserved that animals will eat them to-day. When the first great mammoth was discovered along the rivers of Siberia, the flesh was eaten by the dogs attending the different expeditions; and we have still to-day the head—in fact, almost the entire hide. But, barring these sporadic cases, which are most exceptional, there

* From a lecture by Angelo Heilprin at the Academy of Natural Sciences of Philadelphia, and specially reported for the SCIENTIFIC AMERICAN SUPPLEMENT, these excerpts are taken.

is hardly an instance from an old period of geological time where the actual softened substance has been preserved.

There is no large continental area which does not exhibit somewhere remains of fossil types. We find them distributed from the level of the sea very nearly to the highest parts, in some cases to nearly the tops, of mountains. By far the greater number of fossils so far discovered belong to the types that once inhabited the seas; and inasmuch as they are scattered over the continents, they indicate that the continents were buried in the ocean. Their occurrence at the tip-top, or upper reaches, of the mountain masses—as in the Alps, 12,000 to 15,000 feet high and the higher elevations of the Himalaya Mountains, 22,000 to 23,000 feet—indicates that there has been this change in the position of the land surface relative to the sea since those animals lived. Traveling over the United States from north to south, or from east to west, we find in every single one of our states deposits rich in marine fossils, indicating very plainly life in an oceanic area. Naturally the only one teaching that is brought back to us is that all this part of the United States was at one time ocean; but the geologist has shown very plainly that the different deposits of extinct marine organisms that are embedded in the soft and the harder rocks do not belong to one period of geological time; that some represent the encroachments of the ocean, or the burying of the continent under the ocean, at one time; others at another time. For example, that part of Pennsylvania might have been pressed beneath the ocean 25,000,000 to 50,000,000 years ago; that Florida was pressed under the ocean only a few thousand years ago; so that we have here the exceedingly important teaching of a succession of elevations and depressions, whether actual or relative, between the land and the water. It conveys to us the great teaching of the instability of the continental area as compared with the sea. What the actual teaching of the bottom of the sea is, we are, unfortunately, not in a position to determine, because the greater part of it—almost all of it—is beyond that form of exploration which can make the subject clear or positive to us.

In the greater part of the United States we have the remains of marine animals, and there is no telling but over the very larger part of the sea-bottom we might have the greater part of the animals that once inhabited the land surface; and should this be the case, it would prove that a very large part of the oceanic basin may have been at one time, and at successive periods of time, dry land; that there has been, in fact a complete alteration between the land on one side and the water on the other. I am referring to periods of time following long after one another. Through the indications that fossils give to us of land disturbances of this kind, the biologist is often in position to partially reconstruct land areas for himself; that is, the past extent of land areas is oftentimes defined by the land fossils which they contain. If we find a group of fossils at one part and the same groups of fossils at a very distant part of the earth's surface, and a connecting type between the two, we can unite these areas as having been united by land areas or water areas having animals of the same type. Continental reconstruction is an exceedingly difficult one, even to the geologist, and is attended by great hazard; but, nevertheless, it is being constantly attacked, and it is done with a proper amount of surety; for example the establishment of land bridges connecting the different oceanic areas like the Atlantic and Pacific through the presence of fossil remains, is one which is exceedingly probable on its face, although perhaps differing in form as made by different geologists.

Great changes of climate in the land area have been indicated by fossils. Here is a fossil from Greenland, containing the remains of a large ash tree, as judged by the size of the leaf, because the leaf itself is eight inches across, representing a part of the forest found approximately 70 deg. north latitude, a locality to-day where we find the largest plants not more than about six or eight inches high; and yet the specimen is as perfectly preserved as hundreds of thousands of others, some of them identical, specifically, to that; trees found in the more habitable parts of North America and Europe, and some trees, like the redwood of North America, or the ginko of Japan, indicating that there has been a fundamental change in the climate. Where we have modifications far beyond the limits of forest growth to-day, we have the indications that not only a forest of large dimensions, but also one of temperate or sub-tropical aspect, existed in that region.

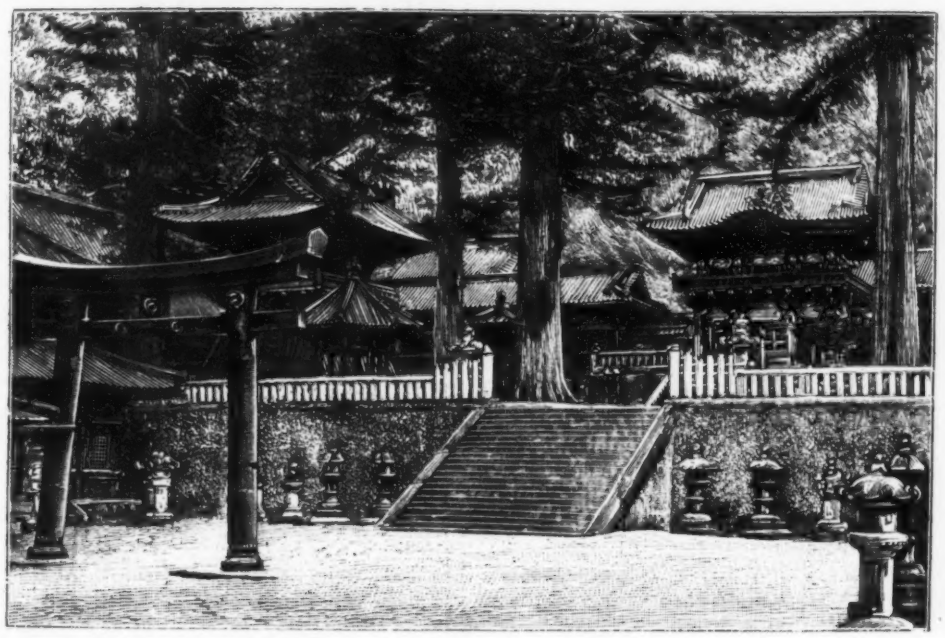
So in the islands of the Arctic region, as, for example, North Greenland and in the Spitzbergen, we have the remains of natural products, which, so far as we are able to determine, represent a sub-tropical climate at 87 deg. north latitude. Only a few years ago the first traces of a fossil forest or fossil vegetation of any kind had been discovered in the Antarctic Continent, where no form of vegetable life is to be found existing to-day; and yet in those same rocks we find traces of giant pine trees of precisely the same type as found to-day in Chile and Peru. So again, in Southern Africa, we have conclusive evidence of past glaciers, indicating at least the presence of glaciers; but here again we are still looking around for the facts of alteration.

Fossils again teach us of peculiar migrations of animal forms. We are in the habit of looking upon the fauna that we find to-day in a country as belonging absolutely to it. What a common thing it is to say that the lion is an African animal or an Asiatic animal; that the dog is an Asiatic animal; that we have the elephant and the giraffe and the rhinoceros representing part of the Asiatic or part of the African fauna; yet the very moment that we investigate the rock deposits of past periods, we find that this habit of association of animal and leaf with a given country is not necessarily an absolutely strict or true one. The deposits of Europe, so far north as England or Scotland, contain the remains of the lion, the hyena, the rhinoceros and the elephant. The question, therefore, comes to us, What relation does this past fauna of part of Great Britain bear to the fauna of Africa to-day? Inasmuch as this fossil remain is far more known than that of any other continent to-day, perhaps the African Continent has derived its fauna from Europe. Possibly the same types found in Europe migrated from Asia. We are not in a position to say definitely how much Africa or Europe has obtained from Asia, or South America from North America, and North America from South America; but the method of research is a perfectly clear and distinct one, and there can be no question but a large part of the continental faunas that are considered to belong to the continents to-day do not belong to them; they are of secondary origin and have been brought to their present places.

The third important lesson which fossils teach us is from the point of view of the zoologist—the most important view of all. From the first beginning of life to the present time there has been continuous change, not merely change from one fauna to another, but the gradual mergence of specific forms of one type into another; that is to say, the evolution of life form. The further back we go in geological history and examine the remains of these different animals, the more we find that the oldest fauna are those that least resemble the fauna of to-day. On the contrary, the fauna of the more recent periods are those which most closely resemble those of to-day, and from the oldest to the more recent there is a gradual progression of type. If a lowly organism is able to survive the conditions which surround it, it is just as high a type as one which we ordinarily designate higher; but the real definition is that from the simple we come to a more complex type—from the somewhat generalized we come to a more specialized—and it has taken those great periods of millions and millions of years to bring us the fauna that we recognize at the present day. But the geologist is very far from showing that the oldest fossil found anywhere represents the in-coming of life. There is very good reason to believe that long before this fossil was created there was a series of like forms extending back in geological history which represented a time period of probably not less than all the time period which has followed from this to the present day—that of that earlier fauna not a solitary trace has been left. It may or may not be represented in the deposits that lie to-day buried in the ocean; but there is no question that like forms long antedated this oldest found, of also a certain amount of complexity. The progression from the simple to the more complicated has been the history of all life form; that the least complicated type is that which has the greatest tendency to survive through a long period. On the other hand, the most complicated type—that which covers the most specialized, like ourselves, or the animals nearest to man—are those seemingly destined to have the shortest existence. It is from the oldest rock formations that we have some of the simplest forms, almost unchanged, coming up to to-day; those of complicated type extend back only for a comparatively short period.

The geologist or the zoologist has not been able to form as yet a distinct successional line—a line along which the different animals go back modified until we get the archetypes of those that obtain to-day; and in order to set aside any impression that a person should receive to the contrary, there is no question that the animal forms radiated or diverged not on one line, but in an almost endless number of lines, which may be said to run or branch out more or less parallel with one another or from the same type. The quadrupeds, the mammals, have in part descended likewise from the reptiles; but even if the birds have descended from the reptiles, we cannot say that the quadrupeds have descended from the birds. We know positively that they have not. So, in the same way, continuing through all the different groups of the animal series, we must picture to ourselves a great number of lines spreading out like the branches of a tree, ultimately, perhaps, to be drawn down to a single stem or stalk; but whether we shall ever be able to discover the actual stem is a question. Possibly we may get very near to it.

PASSAGE LEADING TO THE TEMPLES.



THE TEMPLES OF NIKKO.

Cement for Fastening Parchment Paper to Polished Surfaces.—Macerate, in separate vessels, 120 grammes of gum arabic and 30 grammes of gum tragacanth, each in a small amount of water. When the tragacanth is well swollen and softened, stir until it is homogeneous throughout; the gum arabic is then added and the whole filtered through linen. Incorporate 120 c.c. of glycerin in which 2.5 grammes of thymol has been dissolved. Add water to bring the whole up to 1 liter. This should be preserved in well-corked bottles.

THE WELIN BOAT-LOWERING GEAR.

NUMEROUS devices have been invented for the purpose of facilitating the launching of lifeboats from seagoing ships, the davits now in general use being difficult to handle in bad weather, and always requiring more time to manipulate than is desirable. So far, however, the ordinary davits have held their place, later inventions generally being too complicated and expensive, or more or less unreliable.

We give on this page illustrations of an apparatus invented by Mr. Axel Welin, of 24 and 25 Fenchurch Street, London, E. C. The apparatus seems to offer special advantages in the matter of simplicity and rapidity of operation, besides possessing several other important features.

As will be seen from the engraving, the davit proper consists of an arm which turns about a center, moving along a horizontal guide bar; the lower end of the arm is in the form of a toothed quadrant. The other principal part of the apparatus is a bracket provided with a rack parallel with the guide-bar, and with a running screw for the manipulation of the davit. Both bracket and davit are cast in steel.

The inner chocks are fixed, and support one end of the outer chocks, whose other end is supported by links hinged to the deck, and kept in position by a lever catch or hook.

The handling of the whole gear is very simple. When the boat is being manned, a single grip releases the outer chocks, which are then automatically pushed away by the boat itself when the running-screws are started. On account of the advantageous leverage due to the peculiar movement of the davits along the rack on the base-plate, only one man at each davit is required to manipulate it. The running-screws being threaded right and left, the men stand facing each other, and can therefore see the top of the opposite davit, thus being enabled to regulate the speed as required.

Should the ship have a considerable list, the boats on the weather side could not, with ordinary davits, be got clear of the ship's side, and those on the lee side would get so far out that, in a sea, they would bump up against the ship with terrific force and possibly smash, and the passengers could only get into them with much difficulty. The Welin davits, on the other hand, are always under control, and can be run out to the exact distance required under varying conditions and left there.

Rapidity of manipulation is insured by the fact that no pulling or pushing the boat lengthwise is required in lowering it, and that the weight of the boat itself materially assists the operation. Whether the ship is on a straight keel or not is of little consequence, as two men would under all circumstances be strong enough to run the boat out.

To facilitate the raising of a heavy boat, the boss of the crank may be provided with teeth, and can then be dropped onto an auxiliary pin, thus being caused to gear with the end wheel on the running-screw.

It will be noticed that the davits do not in any way encroach upon the promenading space of the deck.

On account of the flatness of the curve described by the top of the davits during the earlier part of the movement the boat easily clears the edge of the deck, without having the chocks unduly high.

When, however, the davit has reached its outermost position, the top has got several feet nearer the water level, and from 20 feet to 40 feet of "fall" (depending on the number of sheaves in the blocks) may therefore be saved.

The side pressure and any side vibrations that may occur are taken up by the tie-rod, the screw running freely in the nut. No bending strain can therefore come into action upon the running-screw, which has only to withstand the pull of the weight in the line of its own axis. For safety against overstraining by jerks, a thin elastic steel disk (Belleville spring) may be inserted between the end wheel on the running-screw and the inside bearing on the bracket.—Engineering.

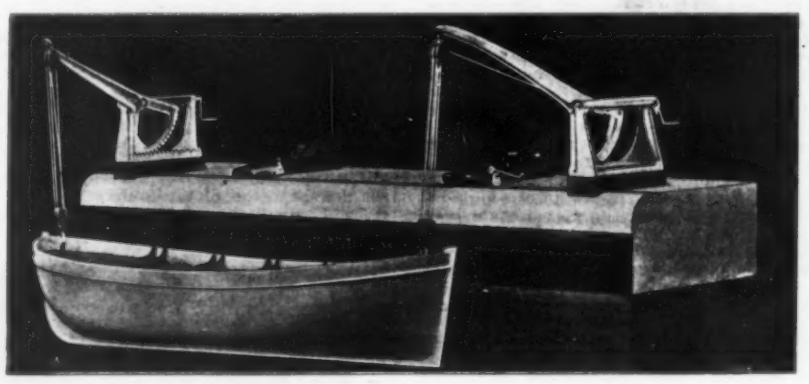


FIG. 9.

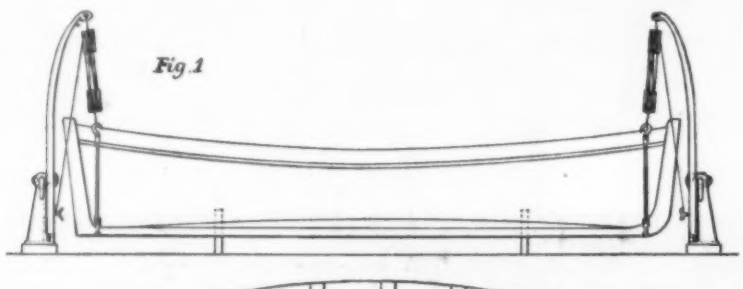


Fig. 1

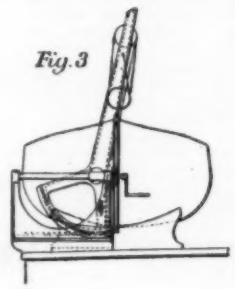


Fig. 3

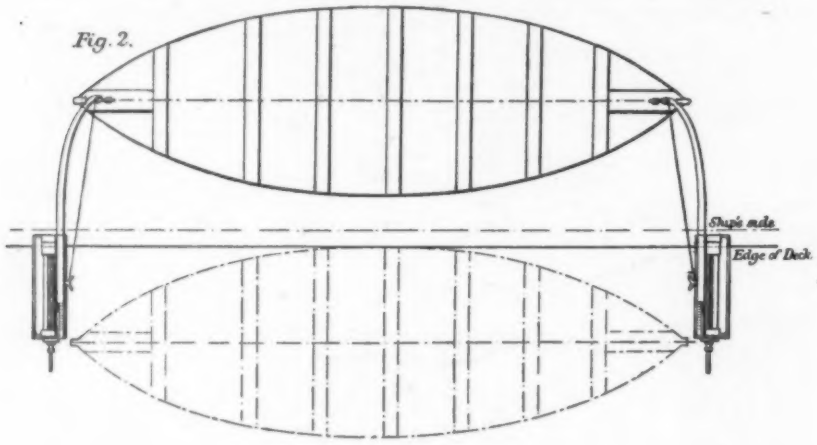


Fig. 2.

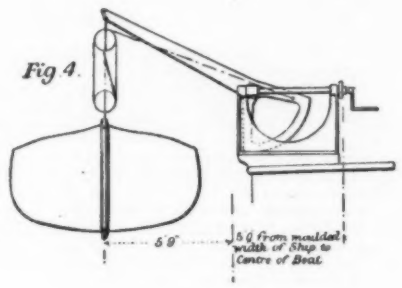


Fig. 4.

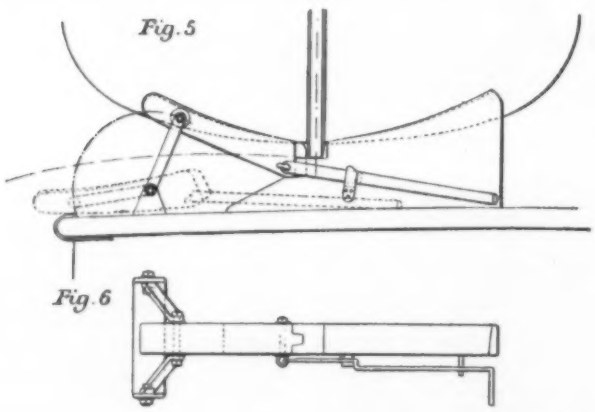


Fig. 5

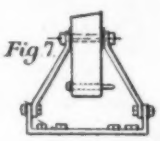


Fig. 7

Fig. 6

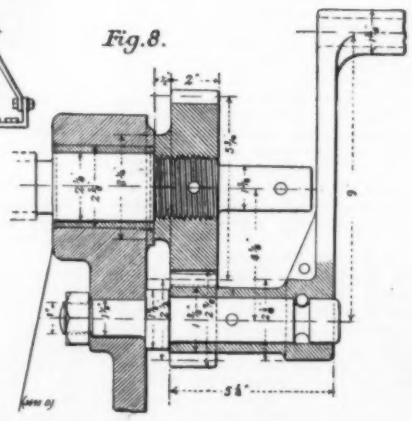


Fig. 8.

THE WELIN BOAT-LOWERING GEAR.

A little turpentine (about a tablespoonful to 5 liters) added to the water on soaking the wash imparts a dazzling whiteness to the latter.

PROGRESS OF MECHANICAL ENGINEERING.

AT a recent meeting of British mechanical engineers Mr. James McKechnie read an interesting paper on the development of mechanical engineering during the period 1891-1901 and the direct effects resulting from such development, particularly as regards speed of warships and merchant liners, as well as on the reduction of coal consumption. Ten years ago the quantity of coal consumed on long voyages was 1.75 pound per horse power per hour; now it is only about 1.5 pounds. Similarly, while it cost some 10 pounds of fuel ten years ago to carry 1 ton of cargo 100 miles, the same work can now be performed with 6 pounds of coal. When it is remembered that these economies apply not to ocean greyhounds alone, but to all "tramps" of a modern type, some idea can be formed of the great saving which is every day being accomplished. Then take the question of speed. Ten years ago no vessel was driven through the water at a greater rate than 20 knots, but now there are several that can travel as fast as from 22 to 24 knots. Some British torpedo-boat destroyers, constructed with turbine motors, have reached the enormous speed of 36 to 37 knots. Going more into details, it is found that while in 1891 there were only eight steamers whose rate exceeded 20 knots, there are now more than fifty on such a list. The vessels between 19 and 19½ knots have also been doubled. Germany still holds first place with the "Deutschland," which is maintaining

an average of between 23 and 24 knots, but British liners, with speeds of over 20 knots, far outnumber those possessed by any other nation. As for size, only two vessels of over 10,000 tons were in existence ten years ago; now there are more than fifty—some of them being over 13,000 tons. Ten years ago, again, there were only ninety-one vessels which exceeded 5,000 tons register, now there are 505. The Germans are displaying considerable enterprise in the production of large ships, but as yet they possess nothing approaching the British-made "Oceanic" of 17,274, or the "Celtic" of 20,880 tons.

SEOUL-FUSAN RAILWAY.

THE promoters of the Seoul-Fusan Railway, having lately completed the issuing of shares for the first period and obtained the sanction of the authorities with regard to the organization of the company, are now arranging to convene a preliminary general meeting with a view to commence work at once. The programme, as stated by Mr. Kasai, chief expert in the service of the company, is as follows:

Route.—The railway under notice starts from Seoul and terminates at Fusan. The most prominent places where stations are to be established are Suigen, 25 miles from Seoul; Tompo, about 50 miles from the capital; Shokuzan, 3 miles south of Tompo, which is noted for rich gold mines; Zengiken, 72 miles from Seoul; Koshiu, 90, and Renzan, 200 miles from Seoul. Between Seoul and Renzan the ground is level, but from the latter point the region is mountainous and the roads are rugged, until at 150 miles the famous Kinzan is reached, a city well known for the production of ginseng. The section of 80 miles between Kinzan and Waikwan is expected to present no small difficulty; indeed, it will constitute the most arduous portion of work on the railway. Beyond the 215-mile mark is a large city accessible from the north through Seido and Enyo, which borders Fusan along the River Rakuto. The whole distance of the line is 287 miles, and, when completed, it will enable the passenger to reach Fusan from Seoul in ten to twelve hours, at an average speed of 28.7 miles an hour.

Tunnels.—These are to be constructed at thirty-one places, and will have a total length of 40,700 feet. The one to be bored through the Hachiroku Pass, between Daiteikin and Sanroshin, will be the longest—1 mile.

Bridges.—The longest bridges are to be constructed at Rakuto and Kiuko, the former measuring 1,400 feet and the latter 1,200 feet. The total length of bridges on the line will be 20,500 feet.

Gage.—In Japan the gage in general use is 3 feet 6 inches, but in Korea it is to be 4 feet 8 inches, so that 75-pound rails may be used. The Seoul-Fusan Railway was originally intended to be a double track, but for the present a single track will be laid, all the calculations relating to the work having been based on that fact.

Materials.—So far as the geological aspect of the country is concerned, no inconvenience will be felt as to the supply of stones for railway and building purposes. But of timber, nothing fit for use can be procured, and it will be necessary to import it from abroad—for sleepers, bridges and buildings of all descriptions. The company proposes to use American pine, and for this purpose is now making elaborate investigations. At the time of the construction of the Seoul-Inchon Railway, a few years ago, American timber was employed at a comparatively small cost, and it is probable that a similar course will be adopted on the present occasion. American pine is estimated to be much cheaper, both as regards cost and transport, than Japanese timber. The clay along the route is believed to be suitable for the manufacture of bricks, and therefore a number of factories are to be established as the work proceeds. Cement must be procured from abroad.

Labor.—Koreans are to be employed for excavation and other labor, as they are twice as strong as Japanese, while their daily wages do not exceed 30 to 40 sen in Korean currency (30 sen is equal to 21 sen in Japanese money).—From the Japan Daily Mail.

TEST OF BALLOON MOTORS.

THE success of M. Santos-Dumont and the partial success of Count von Zeppelin has aroused great public interest. It is rumored that the latter has repaired the serious damage caused by a storm and will soon be ready for a new trial. Our engraving, for which we are indebted to the Illustrirte Zeitung, shows the very severe tests of the motors on a boat 36 feet in length, 6½ feet in beam. With the rearmost screw alone, running at 1,100 revolutions, the boat was driven along at the rate of 6.8 miles per hour. With all three screws running, a speed of 9.3 miles was obtained. Each motor used 13.2 pounds of benzine per hour.

TEST OF BALLOON MOTORS ON THE LAKE OF CONSTANCE.

AUTOMOBILE OPPORTUNITY IN FRANCE.

THE more one studies the tendencies of the automobile movement the plainer does it become that there is an enormous trade to be done here by American firms as soon as they are able to step in and supply the demand.

In previous letters I have outlined the course of the movement and shown that there are two distinct currents of demand, among the wealthier classes for high-class carriages and among the general public for cheaper voiturettes; and while it is hardly likely that foreign makers will be able to compete with the French for some time to come in the production of the best types of carriages, in the construction of which manufacturers have the advantage of a long experience, I think that in the light carriage and voiturette the American is quite capable of designing vehicles as good as anything turned out on this side, and he is certainly able to build them more cheaply.

It is only quite recently that the voiturette has made any considerable progress in this country. For a long time it was overshadowed by the expensive touring carriage and the racing vehicle, for which the wealthy classes stood always ready to pay big prices, and while the leading firms had as much as they could do in this branch of trade they were not inclined to turn their attention to anything else.

SOME LESSONS MAKERS LEARNED.

The demand for automobiles brought any number of new firms into the industry, but as they could not compete with the big makers in their own line they were obliged to create a class of vehicle of their own; and, finding that there was an enormous business to be done among the general public, who were clamoring for light and cheap carriages, they did their best to satisfy the demand.

Many of them learned to their sorrow that the designing of a really satisfactory voiturette presents more difficulties even than the big carriages, and makers had to acquire a lot of experience at great expense before they could exactly hit off the requirements of buyers.

What people wanted here was a light, simple and cheap vehicle, one that did not require a mechanic to drive it, and did not cost much for upkeep; but, though several types of such vehicles enjoyed a lot of vogue for the time being, they soon dropped out of favor when their deficiencies became too manifest.

The earlier voiturettes were too noisy to satisfy buyers, and it was found that their consumption was much too high to make them economical, while in striving after lightness makers cut away the weight of the mechanism to such an extent that failures were frequent, and after a few months' running the spur-wheel gearing was worn out and they were only fit for the scrap heap.

There are one or two types of carriages that are beautiful things to look at, but their life is so short that buyers will have nothing more to do with them. The experience has not been lost, however, upon makers, who have been doing their best to improve the voiturette, with the result that a considerable number of new vehicles are on the market that show a considerable advance on anything previously turned out.

The simpler the voiturette the more satisfaction does it give the owner. They are nearly all propelled by single-cylinder motors of the standard De Dion, Aster or Buchet types, and they may be roughly divided into two classes, according to their systems of transmission—that is to say, those with shaft and bevel gearing, and those with belts running on fixed and loose pulleys arranged for two forward speeds and reversing. With the high-speed motors at present used the belt gives perhaps the best results, and is certainly more durable.

MEETING BELT REQUIREMENTS.

For a long time the belt was objected to on account of its liability to stretch and slip in wet weather, but as the demand always creates a supply the requirements in belts for light motors have now been met by

the manufacture of special kinds that are claimed to be incapable of stretching.

Among the new voiturettes that have been coming into some prominence of late is one constructed by Mr. Bertrand, who was at one time Paris agent for the Cleveland bicycles, and who seems to be doing very well with his little carriage, of which the principal feature is the long belt running from the motor shaft in front to the rear axle. The motor is a De Dion or Aster, as required. One of these vehicles was driven by the well-known artist, Forain, in the tourists' excursion from Paris to Berlin, and another recently won the race from Moscow to St. Petersburg, and was in fact the only vehicle that succeeded in negotiating the Russian roads.

The great fault about these voiturettes is their want of uniformity, by which I mean that there is an entire absence of any attempt at standardizing parts, with the result that if an owner wants to replace a part he has often to wait a considerable time, and it means a great deal of expense. It is just here that the Americans ought to find an opening to step in and secure the trade. The French manufacturer caters for individual customers, but what is wanted are firms who will build automobiles for the market. No one ought to be in a better position for doing this than the Americans, since they have only to apply to automobilism the methods which have proved successful in the bicycle and other trades.

American gasoline motors ought to be specially suitable for voiturettes and light carriages, for the reason that Americans always aim at lightness and simplicity, modifying the design to arrive at this result, instead of merely cutting away metal and suppressing parts, as is the case with French makers, who are often surprised to find, after paring down the weight, that the motor gets hot and liable to derangement, and is of low efficiency.

COMPLETE VEHICLES NOT WANTED.

Some of the smaller American motors I have seen are gems of lightness and simplicity, and the makers producing them ought to do equally well in designing motors for automobiles.

I think there is very little chance of American manufacturers exporting complete automobiles to this country. The import duty on carriage work is too high. But there is nothing to prevent them from sending over underframes, preferably of angle or channel section steel, and not tubes, complete with motors and transmission gears. The maker who expects to get the trade must look after the requirements of the market, or otherwise he will find the stock thrown on his hands.

It is useless, for example, offering French buyers vehicles steered by the tiller or lever; they won't have them at any price. They think the lever is dangerous, and, besides, it is not the fashion. They demand the steering wheel or nothing. Vehicles weighing more than 550 pounds must have a reversing gear, and it would be preferable to eschew bicycle wheels, which are not now used except for the lightest of voiturettes. If these external matters are attended to the maker can do what he likes with the mechanism, provided it is light, thoroughly reliable, economical and durable.

If such frames and machinery were sent over to this country and fitted with carriage bodies by a French maker, who need only build them to one model, I am certain that an enormous trade could be rapidly developed. It is necessary that such parts should be turned out in big numbers, and the French agents should keep in reserve a large stock of exchange parts, which should also be distributed among the automobile dealers in the different towns. Supposing such advantages were offered and the carriages were sold at a lower figure than what is asked by the French makers for vehicles of equal grade, the buyer would give preference to them, because he would know that in the event of some derangement on the road he would easily find spare parts for replacing breakages. The future of the industry undoubtedly lies in the production of cheap and reliable vehicles, with all the parts interchangeable, and with facilities for renewing pieces that are broken or worn out.—Correspondent of the Motor World.

SHIPBUILDING IN THE UNITED STATES.

A FEW years ago Britain produced three tons for every ton of shipping built by all other countries in the world; now the proportion is barely two to one; and although even this preponderance is satisfactory, it is not comforting to know that foreign countries are permanently increasing their productive capacity at exactly twice the rate of our augmentation. The United States shipbuilding returns for the year ending June 30 last are already available, and show that the tonnage launched is 25 per cent greater than in the preceding year, being 401,285 tons—double the merchant output of Germany, but only about a fourth of the British production. In the year ending June, 1900, the total was 305,677 tons, while six years ago it was as low as 111,602 tons. The past fiscal year's total is quite double the average per annum for the past decade. Many of the ships, it is true, were for purely American trade; but the number for over-sea commerce was much in excess of previous years, fifteen such, mostly over 4,000 tons, and aggregating 70,667 tons, having been built on the Atlantic Coast for "foreign" trade, and nine, of 18,888 tons, on the Lakes for transatlantic service. Here in tabular form are the figures for six years:

	Seaboard.	Lakes.	Total, including Mississippi, &c.
	tons	tons	tons
1895	67,127	26,353	111,602
1896	102,544	108,782	227,097
1897	108,504	116,907	232,233
1898	112,879	54,084	180,458
1899	196,120	80,366	300,698
1900	197,902	99,776	305,677
1901	237,058	153,198	401,285

The increase is thus widely distributed. Fewer wooden ships are included, although 22 schooners account for 40,273 tons, with others of smaller size. In view of this striking increase, it is not without interest to review the general practice as it presented itself to the writer during a visit to several of the more important yards in the States last month.

Often as the attention of shipbuilders at home has been directed to the question of pneumatic riveting, one requires actually to see the plant at such works as the American Shipbuilding Company at Cleveland, or those of the Chicago Shipbuilding Company. One is then able to appreciate what a persistent pursuit of this method of riveting will achieve in simplicity of arrangement and in thoroughness. At Chicago, when the writer visited the yard, the bottom portions of the frames of a steamer, some 420 feet in length, were in place, the plates of the inner bottom were for the most part fitted, and the bottom shell plating was well advanced. This seems to be in accordance with the methods there employed; the bottom plates, being prepared off templets made in the mold loft, so that they are ready as soon as the lower frames are erected, and are worked into the ship without any waiting for the side frames; even the bilge plates, for the midship portion of the ship at least, are punched and rolled and lie ready alongside until such time as the side frames are up and ready to receive them. The forenoon of the day of the writer's visit had been attended by a heavy rain storm, and all hands had been knocked off; but under the bottom of the steamer above mentioned a compressed air main, some 5 inches in diameter, lay, running the whole length of the ship; T branches occurred at various positions, and from these flexible branch pipes were led both to port and starboard for the supply of air to the pneumatic tools. On each side of the keel three riveting machines were in place, as left by the workmen, so that on the bottom of that steamer it was obvious that six mechanical riveters were working; this number being in addition to the other pneumatic tools for rimering and caulking. The bottom was kept as clear as possible of shores, and the impression given was, perhaps, that a little less care was taken in this respect than at home; which is perhaps justified by the fact of the ship having no declivity (in view of the subsequent launching being made broadside), a lesser number of shores and the total absence of bilge blocks (at this stage at least) was thus allowable.

In another steamer, launched a few days previously and lying afloat, the writer was more successful in seeing pneumatic riveting actually in progress; the main air-pipe was led along the deck and branches taken off as required through the hatches to the parts below. Some six squads of riveters were working on this ship, and all with pneumatic tools, no sign of hand riveting being visible from stem to stern. The portions in process or riveting were girders beneath the upper deck, and the lower edges of gussets to the lugs attaching the side frames to the margin plates; why these had not been completed earlier was not quite obvious; they were in the nature of odd work, and the possibility of applying pneumatic power to them was correspondingly remarkable. The work produced by the pneumatic riveters is to all appearance excellent; even the keel rivets seemed all that could be desired; the appearance of perfection is supported also by the tests made at the Chicago yard in the way of cutting up samples riveted together for the purpose, and by the still more practical consideration of the difficulty actually experienced in cutting out pneumatically-driven rivets in the frequent cases of repair which have presented themselves. The difficulty, said to be experienced at home, of getting the plates well closed with pneumatic work, is overcome in America by the screwing up being done by a special squad, leaving nothing for the riveters but the actual work of driving the rivets. Fairness of holes, at least when the work is first put together, cannot be said to be a feature at Chicago, the three-ply work especially might well be better than it is; the pneumatic rimering, however, brings things into a fairly satisfactory condition before riveting is commenced.

With the very large development of pneumatic working, it is rather noticeable that at the Chicago yard appliances are in some respects distinctly behind first-class appointments at home. The bottom plates are worked in long lengths, covering fourteen frame spaces; the bilge plates, both upper and lower strakes, cover only seven frame spaces; the reason being that to this day the length of rolls (some 16 feet) at the works determines the limit of these plates. The plate-edge planer matches the rolls in its want of capacity, and requires two shifts of a long plate to complete one edge. No joggling is yet resorted to, and the management is not convinced of the material advantage to be got therefrom. In this shipyard there is at present one gantry or trestle structure surmounted by a traveling crane, the whole being of the type that has been so much discussed of late years.

Naturally, if one wishes to see modern labor-saving appliances on a bolder scale, one must go to the large establishments, such as Cramp's works at Philadelphia, or the New York Shipbuilding Company's works at Camden, opposite Philadelphia. As is well known, the former works have three gantry structures; each is surmounted by a double cantilever crane, so that six ships under construction are served by these appliances for handling the material. At Camden the roofs at present erected cover three bays—one over the fitting-out basin, the other two over building berths, and capable of taking two ships in the breadth; electric cranes, suspended from the roof, traverse these bays. At the Camden works the problem set by the management seems to a casual observer to be how to carry on work differently from the way it is done elsewhere, especially in Britain; the mold loft is a beehive indeed, although there are only some four ships under construction, and none of them has any very special feature about it. Apparently nothing is shaped without a mold from the loft, and, further, nothing is done by hand; the frames are set cold, and a tool something like a bean squeezer is used for the purpose; so far as possible, also, the tool is taken to the work instead of the work to the tool; if an odd hole has to be drilled in fitting together the parts of, say, a hold stringer (this fitting is done on shore), a pneumatic drill is brought to do it. The above remark as to hand work does not quite apply to riveting; for some reason or other, probably a temporary one, the only shell squad of riveters the writer saw were riveting by hand, notwithstanding the fact that close beside them pneumatic rimering and caulking were freely in progress.

Neither at Cramp's works nor at the Camden works is any joggling of shellplates resorted to, speaking, that is, of work now in hand; at the former some bulkhead plates and other minor portions are joggled, but not the heavier work. Hydraulic plant appears less effectively employed than at home; the writer saw little hydraulic riveting, and such hydraulic punches and presses as are in use seem to have the four supporting columns, instead of being open in front, as in the best modern machines. In the plate-edge planers at Cramp's works the plates are held to their work by hand-clamps, instead of by hydraulic presses. In the Camden works less flanging is resorted to than at home, but this is, perhaps, because things are not fully organized; certainly at Chicago flanging is used quite as effectively as in Britain.

The impression borne upon the writer from his somewhat hasty visits was that a judicious selection of American methods is well worth the most careful attention of the British shipbuilder. The American, on the other hand, has something to learn from the methodical equipment of an up-to-date yard in the old country, both in the relative positions of and space allotted to ships' bending-blocks and sheds, and also to the provision of machine-tools of ample capacity for work now common.—Engineering.

ST. PAUL'S.

MR. SOMERS CLARKE, the architect to the Dean and Chapter of St. Paul's Cathedral, writes to The Times as follows:

Many reports have been circulated about the security of St. Paul's Cathedral which are not more remarkable for their conflicting nature than for their lack of authority. The public have been alarmed by statements about serious cracks in the fabric. These there are. They, expecting to see daylight shining through the walls, go away disappointed. Then we see comforting reports that there is really no cause for anxiety. The expectations of the one set of people are as unreasonable as the other reports are untrue. Never having seen any representative of the press, information that has been attributed to me is wholly imaginary. It has been thought well that I should ask permission in your columns to make a statement as to what is the real condition of things, and this I will try to do as briefly as possible.

THE SETTLEMENT OF THE DOME PIERS AND THE WESTERN TOWERS.

Within the first hundred years after the structure of the cathedral was finished the immense weight resting on the foundations of the eight piers which carry the dome and on the foundations of its abutments caused those parts of the structure to sink a little. Most ingeniously spread out as are these foundations so as to cover the largest possible area, the earth beneath them has consolidated rather more than under those parts of the fabric less heavily loaded. The settlement thus caused has broken the eight arches and the windows of the clearstory over them in the nave, the choir, and the north and south transepts, where they abut on the dome piers. In the same way the very great weight of the western towers has caused them to sink. In sinking they have cracked the west front in a vertical direction through the great door, the window above, and the vaulted ceiling of the portico. They have also cracked through the wall of the chapel to the east.

It is very rarely that one finds one of our cathedrals with towers or other heavy features wherein such parts have not been a cause of settlement. Such settlements are not necessarily a cause of serious insecurity, but it is obvious that by them the integrity of the edifice is more or less destroyed. Where the structure was intended to be tied together by continuous masonry the continuity is broken. Arches which should exercise their pressure in a definite direction begin to act in directions unforeseen.

In buildings of pointed architecture such deformations are less serious in result than in those where round arches only are made use of. Pointed arches will undergo the most extraordinary distortions before they finally yield. The moment a round arch is broken or begins to spread the top flattens and its strength is jeopardized.

Above a 100 years since the development of the before-mentioned settlements gave cause for anxiety a system of great iron ties was introduced into St. Paul's Cathedral. These are placed so as to tie back to the dome piers the fronts of the north and south transepts; to counteract, in fact, the want of continuity caused by the breaking through of the arches and window already referred to. But another movement was also observed, and ties were introduced to counteract it. The transept fronts were found to be settling away from the main fabric and also themselves to be settling toward the east and west, this being demonstrated by a crack extending vertically through the windows. The damage in the south transept was greater than in the north, and has since developed. This we can tell by observing the size of the joints between the stones, many of which, after the fashion of the time, were run in with lead, now quite loose and not filling the joints.

WHAT WREN DID.

Wren was well aware that the substratum on which the cathedral was to rest left much to be desired. The mediæval builders as a rule troubled themselves very little about foundations. Wren took all precautions that were known or practicable in his time. Examining the site of his new cathedral he found that, passing through the débris of Old London, he came, at a depth of some 15 feet or 16 feet from the surface, to a layer of clay, or "pot earth" as he terms it. This varied from 6 feet to 4 feet in thickness. The pot earth rests on a stratum of sand (not at all solid) mixed with gravel stones, the lower part wet. Below this, and some 35 feet to 40 feet from the surface, lies the London clay. Wren thought it out of

the question to carry all his foundations down to the London clay. He rejected piles, foreseeing that wells or other things might more or less drain off the water from over the clay, and knowing that unless piles remain always under the same conditions they must certainly rot. He thought best, by spreading the foundations, to float the cathedral on the bed of "pot earth," and thus he built, never dreaming of the desperate attacks the sandy substratum under the pot earth would have to sustain. Had this substratum been left undisturbed, although there would no doubt have been some movement on the structure on the lines of the chief settlement we now see, there is no reason to apprehend that the movement would have continued.

THE TROUBLE CAUSED BY SEWERS AND THE DISTRICT RAILWAY.

The very necessary increase of sanitation and of road improvement was probably the first serious attack on the substratum. The ground on which the cathedral stands slopes rapidly toward the south and west. It is fairly level to the east and north. In all directions sewers were made and at various depths. It was proposed in 1832 to bring a sewer at some 30 feet below the surface through the churchyard on the south and east sides of the cathedral. Immediately the danger to the fabric that this would cause was pointed out, the Corporation of London, which has ever shown the greatest consideration for the cathedral, ordered the works to be stopped. The deep drain in these places has never been made. Unfortunately it was carried up Godliman Street almost into the churchyard, and must have done not a little to drain the substratum, especially near the southwest tower. The level of this sewer is considerably below the bottom of the foundation of the cathedral walls.

Some thirty years ago the Metropolitan District Railway was run under Queen Victoria Street, cutting a large gash along the southern slope of the hill on which the cathedral stands. The railway at its nearest point is but 500 feet away—that is, just about the length of the cathedral. The railway is, in fact, a huge trench cutting into the sandy stratum. The disturbance caused by making such a trench was very great. There cannot fail to have been a considerable change in the water-bearing conditions just above the London clay. A cutting once made the water will always follow it. Below the underground railway there has since been pierced the tube for the Waterloo and City Railway. How far this is down in the London clay I do not know.

We find, then, that the southern slope of the hill on which the cathedral stands is fairly riddled with excavations of one sort and another. There are sewers, the underground railway and a tube at a lower level. The most remote of the railways or tubes is but just 500 feet from the cathedral foundations. Those who have studied earth movements, the result of deep excavations, know that a great deal of dislocation takes place in a line diagonally right and left of the parts excavated. The fact that the underground railway is 500 feet off does not insure that resultant earth movements do not come much nearer to the cathedral.

FRESH INDICATIONS OF SETTLEMENT.

During the last twenty years fresh indications of settlements have been showing themselves in the walls of the church. The movements are still in progress. Those most to be observed are on the south side. The worst are in the south transept. The way in which these have moved since the ties of 100 years ago were inserted shows that the settlements are due not to the thrusting of arches in the fabric itself, but to the subsidence of the mass which at this place consists of a wall from 8 feet to 10 feet thick, 130 feet long, 130 feet high, and weighs between 12,000 and 13,000 tons.

The arch of the window head is so broken that the great keystone carved with a cherub had dropped more than 2 inches from its place. Before the repairs just completed it was quite loose, and was merely held by the pinch of some stones at the back and by the ironwork of the window. The wall has, in fact, split vertically through the doorway and the window over it, sinking gently in two masses right and left. The coffered window head we see from inside the church is quite out of shape, and the same dislocation in a less degree may be observed over the windows of the clearstory adjoining. The massive iron stanchions intended merely to resist the wind and to give rigidity to the lead glazing are now bent by the weight of the window arches pressing upon them. It would be going into too much technical detail to state in your columns where there are other indications of movement. It is enough to say that they exist on the south side of the church, and we know that some of them have continued to develop during the last three years. They are still developing.

THE FUTURE.

If we suppose it possible that the subsoil be left from thenceforward untouched, the settlements are of sufficient importance to make it necessary not only to watch them carefully, but to expend considerable sums (out of a very limited income) on their repair. During the last four years the chapter has had to find the money for such works. But now comes the attack by the electric railways. One of these—the Victoria, City and Southern Electric Railway—proposes to come under the churchyard, taking a line between the cathedral and the great warehouses on the south. The center line of the tube or tunnel would be about 40 feet from the southwest tower and 50 feet to 60 feet from the south transept. Another—the Piccadilly and City Railway—proposes to pass under Carter Lane—that is to say, under the first street immediately south of St. Paul's Churchyard. The center line of this tunnel is at a distance of 170 feet both from the southwest tower and the south transept. It would be a little nearer to the cathedral than the width of the west front. It would be but 300 feet from the center of the dome.

We must not forget that the cathedral is already attacked on the north. Here is the tube of the Central London Railway, and this is but 460 feet from the center of the dome. We know that this tunnel, passing as it does close to Bow Church, has already in the few short years since it was pierced caused the steeple to overhang 1 foot 9 inches toward itself. Bow Church tower is a mere toy compared with the enormous weight of St. Paul's. The area of one of the western towers of St. Paul's is just double the area of Bow Church tower.

THE CHIEF DANGER TO ST. PAUL'S.

But the chief danger to the cathedral lies by no means only in piercing the tubes or in the vibration from passing trains. The tubes may be sunk ever so far down, the vibration may, and no doubt will, be very much reduced, but wherever the tube may be a tremendous hole must be made for the public to get at it. Then, when the bottom is reached there are footways, cross passages and all manner of subsidiary excavations. Who knows what underground streams may not be tapped in making these big shafts or how much superincumbent weight may affect excavations? The Piccadilly and City Railway proposes to place its terminus under the space where Cannon Street is crossed by Queen Victoria Street. The tunnels in which is the terminus must necessarily be of considerable length, and can hardly fail to come within 600 feet of the cathedral. The great hole and excavations to the east are, however, not more dangerous than would be those to the west on the slope of Ludgate Hill, where a station is projected. There is already, on the north, the Post Office station of the Central London Railway. The results of these big excavations and disturbances would very probably not show themselves seriously in the fabric of the cathedral for a good many years; but what is, let us say, fifty years in the life of a great national monument, one of the most magnificent buildings in the world, and which, taken due care of, may last for 1,000 years or more?

Mr. Charles Reilly proposes, as a means of rendering the cathedral secure against any dangers occasioned by underground railways or sewers, that the building should be supported on the bed of blue clay 35 feet below the surface. The cost of the underpinning necessary he estimates at £220,000. He has recently done the same thing to the hall of one of the City Companies, within 50 feet of the Stock Exchange itself, when isolated stone piers weighing 300 tons were safely underpinned to a depth of 50 feet without cracking the plastering in the rooms above.

THE MANAGEMENT OF SIMPLE CASES OF INSOMNIA.

By A HOSPITAL PHYSICIAN.

WHEN to give a hypnotic—what one to use—how much to use—how long to continue it. These questions are frequently before us for thought and decision, and on our decision may hang many far-reaching results. We must know the mental and physical condition of our patient and the usual actions of the drugs, for all hypnotics have other actions besides the one of causing sleep. We must remember that all drugs act differently on different persons, and none vary more than those acting on the nervous system. A person who is strong and vigorous may be very differently affected from one who is weakly. It is not always the apparently robust who can take large doses without ill effects. Many apparently healthy people really have weak hearts or irritable kidneys, and the condition of these organs in particular should be known to be normal before any hypnotic drug be given. Then, too, the mental state of the patient should be known, for it is very easy to get into the habit of taking "just a little powder when one cannot sleep." Nothing requires more strength of mind and will than to lie awake at night when everyone else is sleeping. And nothing is harder to break away from than the habit of taking "just a little" when it is once formed. Then, too, an improper dose of a proper drug may have an exciting instead of a soothing effect, and we must always guard against the possibility of harm being done by an unintelligent carrying out of orders, and an overdose being given unintentionally. The chief bad effects of drugs that we shall mention are the danger of contracting the habit of using them, as already mentioned, and the effects on the heart, the kidneys and the bowels.

Nearly all hypnotics are directly depressing in their action on the heart. This is at times an advantage when that organ is acting too vigorously, but it must be most carefully watched. It is frequently advisable to combine a small amount of stimulant with the hypnotic, either giving them both together or giving the stimulant in smaller dose at intervals. The action on the kidneys is usually that of an irritant. They are usually eliminated in part by the kidneys, and under normal conditions are excreted properly and promptly. When for any reason the excretion is not prompt and the drug has to be repeated, we may get a cumulative effect which is very undesirable. Under normal conditions the urine is usually somewhat increased in amount. When there is already a pre-existing disease of the kidneys, the urine may be decreased in amount or even suppressed. The action on the bowels is almost always constipating, not so much by a direct action as by the indirect one of reducing the vigor of all the organs. The dangers of constipation have been spoken of in a former article, and need not be repeated.

Let us first speak of the methods of inducing sleep without the use of drugs. These are, of course, to be urged upon a patient first. If they fail, we must then use medicine. The first thing is to find out for certain if the digestion is as it should be and to attend to this before the sleeplessness. Any disorder here having been rectified, we begin with the simple home remedies that are not always thought of at home, but which are frequently sufficient.

First of all we should mention a well-ventilated room—not heated above 60 deg. F., and better 55 deg. F. for an ordinary adult. The aged may be given a higher temperature, and of course during the summer such a temperature is usually impossible. The bed clothing should be sufficient but not excessive. Blankets are preferable to quilts and comforters in that they do not weigh as much for the same amount of warmth.

The counting of plain numbers or "black sheep jumping over a wall," or the simple repetition of any meaningless phrase is to be tried.

If this is insufficient, try bathing. Either a hot or cold plunge is frequently efficacious. Care must be taken not to prolong the bath too much. If there is not a bath tub, we may use the sponge bath or the foot bath. The latter is frequently of use when made hot with a drachm or two of mustard added. Then, after a brisk rubbing down, the patient is ready for bed. Bathing should be absolutely the last thing done. There should be no further duties of any sort, not even to go to see if the front door is locked, if the windows are properly arranged in case of an unexpected shower, if the furnace is in proper condition for the night.

Again, some people will sleep if they simply change their room, or by sleeping alone if they have been occupying a room with someone else, or by having a faint ray of light instead of absolute darkness.

Then massage is useful. If there is a competent masseur or masseuse at hand, he or she may be employed to give a regular course of treatment, care being taken to insist on the movements being made slowly. If there is no trained assistant at hand, there may be someone who can be taught how to rub the head and the feet. As a hypnotic, rubbing the feet very slowly and evenly is about as good as anything. It may take a long while—even an hour—but, as a rule, after a hot bath, if it is done slowly and evenly, the patient will be quiet in a very few minutes and will sleep in from a quarter to half an hour. Of about the same efficacy is rubbing the head, but it is harder to do well. It must be insisted upon that there be no conversation, laughing or the like. The process need not be funereal, but it should be quiet, with little or no light in the room.

Coming now to a little more medicinal treatment, we may find that a copious hot drink of almost anything may be useful—for example, hot milk or beef tea. In the aged a cup of black coffee, or caffeine ½ to 1 grain, at tea time or on retiring may improve the cerebral circulation so as to induce sleep. Where the sleeplessness is due to over-fatigue we may be able to convert the fatigue into plain natural tiredness by a little stimulant. Here it is that the hot drink is the most useful, and if it fails we may try strichnine 1-200th to 1-75th grain. The dose should not be large enough to act as a marked stimulant lest it act as an excitant.

We now come to the use of hypnotics. There are many of them, both official and unofficial. To attempt to enumerate and go into their physiological action, therapeutics and toxicology, would take too long and would be simply rehashing the materia medica. We shall mention briefly only some of the advantages and disadvantages of some of the most common ones when used alone and in combination. Sometimes by combining a moderate dose of two drugs we can get the combined good effects of both without the bad effects of a large dose of either.

First and foremost is opium and its constituent active principle. It is the most powerful, the most valuable, and the most dangerous drug we have. For the purpose of this paper it may be dismissed with a word—never use it for simple insomnia. Never use it except for pain that cannot be relieved in any other way. Find the cause of the pain and relieve it. If it is a surgical pain, like that of appendicitis or a bone felon, treat it surgically. If it not surgical, find out what it is due to and treat the cause, and do not give opium till all else fails. When it does become necessary to give it, be sure the patient does not know what is being given.

Chloral hydrate is a powerful drug at times, but its effects vary greatly. It is very depressing to the heart. The habit of using it is easily formed. Care must be used in giving it to alcoholic subjects, as they frequently get the depressing rather than the hypnotic effects. By alcoholic subjects, drunkards are not necessarily meant. There are many "alcoholics" who would be amazed to hear themselves classed as such, for they were "never under the influence of liquor" in their lives. It is the person who has always taken a few drinks a day, who always has a little alcohol circulating in his body, who is "an alcoholic" in the scientific acceptation of the term. When it is best to use chloral, it is best combined with sodium or potassium bromide; for example, chloral hydrate 5 to 15 grains, pot. bromide 15 grains to ½ drachm, and to give it by rectum with 1 to 3 ounces of water.

The bromides act slowly and are not very good as hypnotics when given alone, but when in combination with a quicker-acting drug like chloral, as already mentioned, they prolong its action without doing the harm a larger dose of chloral might do.

Sulphonal is a useful and also a dangerous drug. When used continuously, it is not excreted rapidly, so there is a cumulative action. It almost never acts under from 2 to 3 hours, and may not for 24 hours. It frequently depresses the heart action. There is marked danger of contracting the habit of taking it. Its continued use may cause delirium and all sorts of delusions. When it is used, it is frequently well to combine it with trional, which is a quicker and more evanescent acting drug. It is less irritating. There is less danger of contracting the habit. It helps the sulphonal, and we get a quicker, surer effect from a moderate dose of both than from a large dose of either. For example, it is frequently well to start with trional 10 to 20 grains, sulphonal 5 to 10 grains. This will usually induce sleep in half an hour or an hour, which will last from four to eight hours. If this dose is not enough, a little more may be used, though it would be better to use something else. If this dose is sufficient, after a few nights it may be decreased a little and a little sod. bicarb. added. Then this mixture may be used on alternate nights with plain soda on the other nights. Then plain soda may be used every night. In order to carry out this plan, one must have the intelligent co-operation of the nurse or some *one* member of the family. The patient, of course, must be kept in ignorance of what he is taking. It is impossible to keep the plan secret if many people know it. The reason for adding the soda to the others is that the difference in taste may not be too noticeable when only soda is given. The writer has seen this plan successful in many cases, especially

in hospital work, where it is easily possible to prevent the patient and his friends from knowing what he is taking.

Paraldehyde is uncertain in its action, is apt to upset the stomach, and if needed for a long time loses its effect. When it does work at all, it does it well as a general rule. The dose is ½ to 1 drachm.

Amylene hydrate given by rectum is often excellent. Given in this way, it is not irritating and the sleep may last from four to eight hours. It not infrequently fails. Given in this way the dose is from 1 to 3 drachms.

Cannabis indica is not as much used now as it was some years ago. Its place has been largely taken by trional. It has the peculiar property of obliterating all consciousness of time and space, so that a few moments may seem like hours while the general consciousness is unimpaired.—The Druggists' Circular and Chemical Gazette.

SYMRNA FIG CULTURE IN THE UNITED STATES.*

By L. O. HOWARD, Ph.D., Entomologist.

Introduction.—That an article bearing this title should be prepared by an entomologist may seem at first glance unusual, not to say curious; but as is well known to those informed on the subject, and as will be readily seen by the readers of this article, the problem of establishing the Smyrna fig industry in the United States has been very largely an entomological problem.

Fig culture has never amounted to much as an industry in this country. Fig trees grow abundantly throughout the South and in California, having been introduced by the early French and Spanish settlers, and there have been more or less frequent importations since. As a domestic fruit, the fig is of considerable importance in all the Gulf and South Atlantic States. It is a common dooryard tree throughout this region. It has been grown with more or less success as far north as the Lower Hudson River Valley, and where well cared for during the winter it will bear well for years, even at these northern limits. In the South figs are used almost entirely for household purposes. They are eaten fresh from the tree and are served on the table with sugar and cream. They are also stewed and made into puddings and pies, and are canned and preserved. In this section figs are occasionally, but seldom, dried for household use, as they ripen at the period of summer showers, which makes drying difficult. Much more of an effort to produce a salable dried fig has been made in California than in the South, especially during the last twenty years, and a greater success has been secured, probably on account of the drier climate. Fig trees were grown in California by the early Spanish padres, probably as early as 1710, and have flourished throughout the southern part of the state, one of the largest and most remarkable trees in America growing as far north as Chico (130 miles north of San Francisco), on the Bidwell place, where it was planted in 1856.

Attempts to Grow the Smyrna Fig.—After the early attempts to dry figs in California had progressed for some years it was gradually realized that with the varieties then growing it was impossible to arrive at a product which should compare in quality or commercial value with the Smyrna fig of commerce.

Attempts to Grow the Caprifig.—The importation at this time of the wild, or caprifig, cuttings was the most important step which had yet been taken toward the solution of the problem. This importation was due to the tardy recognition of the fact that the Smyrna fig, the standard fig of commerce, owes its peculiar flavor to the number of ripe seeds which is contains, and that these ripe seeds are only to be gained by the fertilization of the flowers of the Smyrna fig with pollen derived from the wild fig, or caprifig. Since time immemorial it has been known that in Oriental regions it has been the custom of the natives to break off the fruits of the caprifig, bring them to the edible fig trees, and tie them to the limb. From the caprifigs thus brought in there issues a minute insect, which, covered with pollen, crawls into the flower receptacles† of the edible fig, fertilizes them, and thus produces a crop of seeds and brings about the subsequent ripening of the fruit. The careful investigations of Count Solms-Laubach and Fritz Mueller, in the early '80's, and later those of Dr. Paul Mayer, have shown that the varieties of the wild fig, or caprifig, are the only ones which contain male organs, while the varieties of the Smyrna fig are exclusively female. In the caprifig there is said to exist in Mediterranean regions three crops of fruit—the spring crop, known as "profichi," the second, as "mammoni," and the third, as "mamme," the latter remaining upon the trees through the winter. The fig insects (the Oriental species be-

FIG. 2.—A BRANCH OF A CAPRIFIG TREE (ROEDING'S CAPRI No. 1).

Photographed on March 30, showing two winter figs or mamme (the two nearest the right side of plate), from which the hibernated Blastophagas are about to issue, and a bunch of spring figs or profichi (near the tip of the branch), which are in the receptive stage, that is, ready to receive the Blastophagas issuing from the winter figs. (Reduced from an original photograph.)

ing known as *Blastophaga grossorum* Gravenhorst) overwinter in the mamme, oviposit in the profichi, develop a generation within it, each individual living in the swelling of a gall flower (a modified and infertile female flower), and issue from it covered with pollen, enter the young flower receptacles of the Smyrna fig, which are at that time of the proper size, and make an attempt to oviposit in the true female flowers, fertilizing them at the same time by means of the pollen adhering to their bodies. The life history of the insect from that time on was not well understood, but the Blastophaga was known to occur again in the overwintering or mamme crop of figs.

Early Attempts to Introduce Blastophaga.—The introduction of Blastophaga, the fig-fertilizing insect, was first attempted by private enterprise. Mr. James Shinn, of Niles, Cal., obtained the first specimens in July, 1891, but want of sufficient caprifigs for their propagation made the venture a failure. There was at that time only one caprifig tree on his place. The tree had just finished shedding, practically, all ripe caprifigs, and only a dozen ripe figs yet remained on the tree. There was absolutely no sign of a succeeding crop, and the hatching Blastophaga had no caprifigs in which to lay their eggs. As Dr. Eisen has remarked, "with only one caprifig tree, and that one bearing only one crop a year, this importation could not possibly have been a success." These first Blastophagas were imported with the help of a missionary in Syria. In 1892 Mr. George C. Roeding secured several consignments of figs containing Blastophagas from Smyrna, most of which arrived in good condition. On cutting a fig open hundreds of the insects emerged, flying around in a large Mason jar, in which he placed the fruit, and these insects were afterward placed in a covered tree to note the ultimate result. Mr. Roeding also tried two other interesting experiments, but which were foreordained to failure; the one was the introduction of native Blastophagas from Mexico and the other of native Blastophagas from Hawaii. In 1890 the writer remembers to have seen some caprifigs received by the Division of Pomology from Turkey which contained living Blastophagas, but there was at that time no place known to the Pomologist to which they could be sent. Mr. Roeding from year to year continued his artificial fertilization of Smyrna figs at his Fresno place, and in 1897 a box of figs fertilized in this way was sent by Mr. Roeding to the Division of Pomology. The writer was shown some of these figs by Mr. W. A. Taylor, then acting pomologist, and their flavor at once convinced him, if he needed conviction, that the true taste of the Smyrna fig was there.

Successful Importation by the Department of Agriculture.—Up to this time the Department of Agriculture had made no serious effort to import Blastophagas but being convinced by letters from Mr. Roeding, and from statements received from the San Francisco Board of Commerce, in the late autumn of 1897, that probably the time had arrived for such an attempt, the writer was authorized by the Secretary of Agriculture to take charge of the work, and to attempt the importation and the establishment of the insect. It happened, however, that just at that time Mr. W. T. Swingle, a competent botanist in the employ of the Division of Vegetable Physiology and Pathology, was in South Europe on leave of absence, and it happened also that while studying at the Naples station Mr. Swingle had become interested in the subject of the fig, its origin and bontanical varieties, and the phenomenon of caprification. This fact coming to the writer's attention, it was deemed advisable by utilizing Mr. Swingle's services to save for other purposes the funds which would have been required to send out a new man.

Another preliminary step undertaken by the writer was to visit California, in the early spring of 1898, to inspect the points where Smyrna figs and caprifigs were supposed to be growing, so as to be able to decide upon the best point or points at which to attempt the establishment of the insect in the tolerably certain event of its successful introduction in living condition. Upon reaching Mr. Roeding's place near Fresno, the writer was at once assured by the thriving condition of the trees, and by their great number (nearly 5,000 in all, including 100 caprifigs), that no better place could possibly be found, or could be prepared in several years.

At some personal expense and on his own initiative, Mr. Swingle began in the spring of 1898 to send a number of caprifigs containing gall insects to the Department of Agriculture at Washington city for shipment to California, and made a careful study of the different varieties of caprifigs. The first shipment arrived at Fresno in April, 1898. It had been sent from Naples, the locality in which Dr. Paul Mayer had made his investigations. Each green caprifig was carefully and closely wrapped in tin foil, the end being covered with wax. On arrival at Fresno the female Blastophagas were seen to be emerging from the gall figs. A caprifig tree was inclosed in a thin cloth tent and subsequent sendings of caprifigs were placed in this inclosure, and the Blastophagas were liberated.

Then a year elapsed without result. Either none of the caprifigs on the inclosed tree was stung by the Blastophagas or no larvæ developed, so far as Mr. Roeding could observe.

In the meantime Mr. Swingle had been transferred to the Section of Seed and Plant Introduction of the Division of Botany and commissioned as an agricultural explorer to work at the introduction into the United States of desirable plants. In the course of his work he went to Greece, and from there sent additional varieties of caprifigs to this country, which

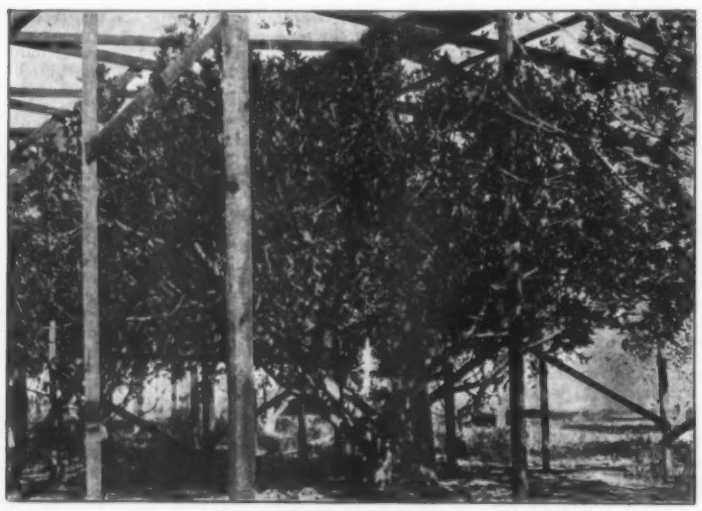


FIG. 1.—A TEN-YEAR-OLD CAPRI TREE (ROEDING'S CAPRI No. 1).

Tree, in prime condition, as seen on March 30, when the young foliage was not yet fully developed; had been protected during the winter by a canvas tent, and the illustration shows the framework of the tent. (Reduced from an original photograph.)

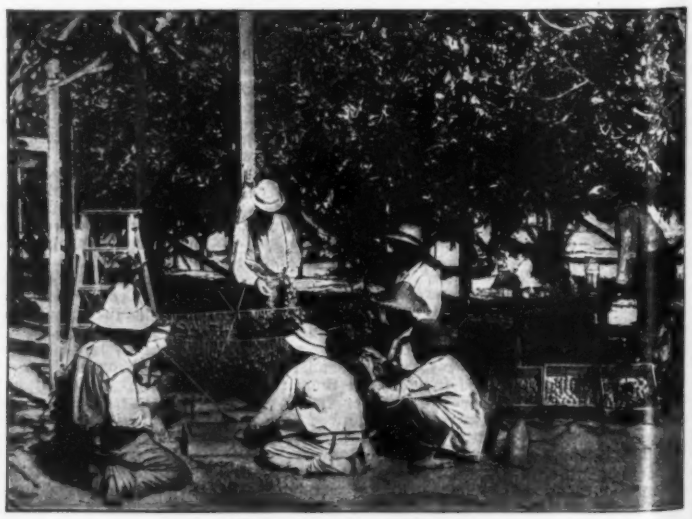


FIG. 3.—CAPRIFICATION.

The process of sorting, examining and stringing the profichi figs preparatory to their distribution upon the Smyrna trees. (Reduced from a photograph taken June 13.)

* Abridged from the Yearbook of the Department of Agriculture for 1900.

† The fig is not a fruit in the ordinary sense, but a flower and seed receptacle.

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were forwarded to Mr. Roeding and planted under differing conditions.

In the winter he went to Algeria and sent other cuttings and one large caprifig tree. As the spring opened Mr. Swingle again began his sendings of caprifigs, packed as before, and which, as before, were

FIG. 4.—CAPRIFICATION.

Distributing the profichi figs upon the branches of the Smyrna tree. (Reduced from a photograph taken June 13.)

placed by Mr. Roeding under the artificial inclosure. This time, as before, Mr. Swingle adopted the innovation of sending the winter generation of caprifigs instead of the spring ("profichi") generation, and to this important change is doubtless due more than to any other cause the success of these sendings, since, so far as can be learned, all earlier importations had been of the profichi generation. On March 31, 1899, six boxes of caprifigs were received by the writer and forwarded to Mr. Roeding; on April 5 one more box, and on April 6 the eighth and last. On April 6 the first boxes were received by Mr. Roeding. The fruits seemed to be in excellent condition. He cut several open and found them full of Blastophagas in the pupa condition. All of the figs were cut open and placed under the covered tree.

In view of previous failures and this lack of confidence on Mr. Roeding's part, the pleasure of every one concerned in the results which followed can readily be understood. In the latter part of June, 1899, one of Mr. Roeding's men was engaged in gathering caprifigs and extracting the pollen for the purpose of artificially pollenizing Smyrna figs by means of the usual blowpipe process, and on the 23d of June he found one fig which contained evidences of the presence of the insect. On the 24th of June the tented tree was examined, and it was found that all the figs had dropped and shrivelled up with the exception of about 20, which were still green and plump, and which subsequent evidence showed contained developing Blastophagas. Other figs showing evidences of Blastophaga were found on outside trees, and by the end of June were found other wild fig trees upon which young figs, presumably the second crop, or mammoni, were beginning to develop. On the 30th of June a tree 1,500 feet away from the tented tree was found bearing two caprifigs containing galls and male insects.

About the middle of July Mr. Roeding found a few neighboring Smyrna trees which had been fertilized by the Blastophaga without any effort on his part.

About the end of August some of the caprifigs of the second crop (mammoni) had begun to come to maturity, but many young caprifigs were also present, and the insects entered them. By November 10, when Mr. Swingle visited Mr. Roeding's orchard, many swollen caprifigs were to be seen, which had been supposed to be the overwintering, or mamme, generation, but on that date and for a number of days subsequently thousands of the insects emerged, thus producing at least a partial fourth generation of the insect, a fact entirely unprecedented in the history of the species, so far as the writings of the European authors inform us. These entered at once the young individuals of this generation of figs, as could readily be observed at the end of November, when the writer visited the orchard, the minute wings of the insect being found adhering to the bracts on the outside of the fruit, while living males were still found in the older figs from which females had issued earlier.

CARRYING THE INSECT THROUGH THE WINTER.

In November, for the purpose of protecting a goodly number of overwintering figs containing insects from possible freezing weather, Mr. Roeding built a cloth house 28 by 17 by 16 feet high, in which three trees were inclosed, in all bearing fully a thousand figs. At the time of the writer's visit (November 23-25, 1899) the cloth house was found to have been admirably designed. There was a high square framework of joists (Fig. 1), with the canvas buttoned on over nails, so that a free circulation of air could be allowed and the trees could be entirely uncovered with a minimum of trouble in fine weather when no frosts were anticipated. The estimate of about 1,000 gall figs was confirmed and other trees outside the tent were found to carry a few caprifigs of the overwintering generation. Although Blastophagas had issued on the 10th of the same month, and although November 24 was a bright warm day, with a temperature of 83 deg. F., there were no signs of any insects issuing. One of the larger figs, in which the eye had opened, showing that the insects had probably issued on the 10th, was opened and was found to contain 1 dead female and 3 living males, the latter very lively.

At this time some extremely small caprifigs were seen, and with a warm winter promised to be receptive to any Blastophagas which might subsequently issue. On the terminal twigs the buds seemed almost ready to swell.

From this time on the winter was passed without any occurrence worthy of especial note. About December 15 there was a frost of 29 deg. F., and there were several light frosts later. On January 1, 1900, some of the large figs dropped from the tree under the cover and were found to contain fully developed male and female insects.

Upon his arrival at Fresno, Mr. Schwarz, an expert assistant delegated to the work, found that two of

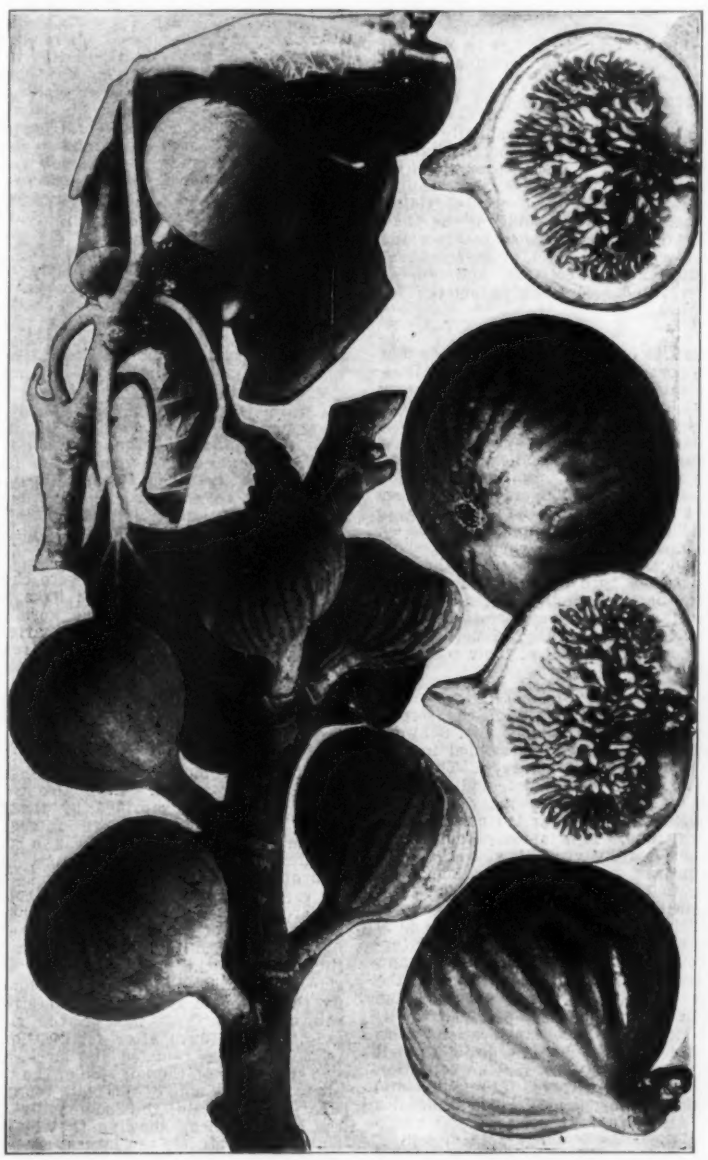


FIG. 5.—CAPRIFICATED AND NON-CAPRIFICATED FIGS.

the tented trees and some of the trees outside of the tent, all belonging to the same variety of capri trees, bore about 400 apparently sound overwintering caprifigs. By March 18 many of the spring crop were seen to be as big as cherries, and with difficulty distinguishable from the smaller overwintering individuals. The larger overwintering specimens continued dropping, and all were found to be more or less affected with rot. To Mr. Schwarz it seemed probable that these larger individuals, which are pulpy in their character and which still contained full-grown insects, were not true mamme, but simply hibernating mammoni of the mammoni crop of 1899. In Europe this phenomenon is known; the belated mammoni are said even to stay over winter on the trees, maturing in the spring, and thus hardly to be distinguished from the genuine mamme in general appearance. In these larger specimens, which were taken to be belated mammoni, the insect was found all through the winter in the pupal or adult conditions, whereas Mayer and Solms-Laubach state that in Europe in the mamme the Blastophaga hibernates in the egg or larval condition. The issuing of the insects from these figs had evidently been prevented by the presence of a large amount of saccharine matter, and the greatest hope at this time was that the smaller figs, evidently the true mamme, would contain the insect in the proper condition to issue at the proper time. This generalization held not only for the figs upon the tented trees, but upon the others outside.

THE EMERGENCE OF THE INSECTS IN THE SPRING.

The adult Blastophagas from these overwintering small figs began to issue March 28, and continued to do so for about five weeks. If the weather had been fair and warm this period would have lasted probably only three or four weeks, but bad days intervened, and the time was extended. Upon issuing, the adult female Blastophagas immediately entered the spring generation of caprifigs, which were in the proper receptive condition. Mamme, from which the Blastophagas were issuing, or were about to issue, were transferred to other trees, with the result that on June 10 Mr. Schwarz wrote that at that time the total crop of good profichi was estimated at about 6,000. With knowledge gained later, a much larger number of good profichi figs could have been obtained if the transferring of mamme had been concentrated upon fewer trees, but since the orchard contained three varieties of capri trees, and since their qualifications were not well understood at the time, it was deemed best to distribute the insect over as many capri trees as possible. Some interesting practical information was thus gained—the Blastophaga emerging from the mamme oviposits preferably only in such profichi as are shaded, evidently not liking to work in the sun, and probably because the figs grown in the shade are cooler and fresher. The most valuable figs for this purpose seem to be those which grow on the small inner twigs which never reach the top nor the sides of the tree. Unfortunately, this inside growth in the orchard had been carefully trimmed out on most of the trees. This affords a cultural point of value for

future experience. The average California horticulturist, judging from the writer's experience, finds his ideal of a fruit tree in its symmetrical and beautiful outline, but while this may be good for other fruits, it apparently does away with the bearing capacity of a fig tree of the Smyrna class.

THE SPRING CROP OF CAPRIFIGS.

A natural spread of the insect was allowed to take place from two of the overwintering trees; but it was found that only a few neighboring trees could be caprificated in this way. The result of the transfer of the mamme to other trees was that a sprinkling of good profichi was gained, either good or poor, according to the variety or individuality of the trees, and, of course, also according to the number and quality of the suspended mamme. It appeared also that the mamme suspended previous to April 10 produced better results than those suspended afterward, and it seemed that a caprifig tree in good condition requires at least 25 mamme to have a chance to be fully caprificated. This number, however, experience may lessen very greatly; in fact, at that time, while it was supposed that the method adopted of scattering the few mamme all over the row would not be favorable for a commercial purpose on account of the trouble in gathering the scattered crop, it has been found not to be so unfavorable after all. Many of the profichis, as above indicated, drop either by rubbing or by the action of severe winds, or by means of a disease which Mr. Schwarz terms "the ostiolum disease."* The insects themselves in this crop are, many of them, lost in numerous ways: They may issue as cripples and not be able to fly; they may be caught in spiders' webs; they may be caught in the sticky exudation from certain of the figs; they may lose their wings in attempting to penetrate, without success; they may die through entering figs which are too small, or several may enter the same fig; they may be blown away by the wind; they may enter figs which are too old. It was also noticed that the insects are very shy, and that when they issue from the mamme they drop to the ground on the slightest provocation. In these various ways, it was estimated that more than 50 per cent of all the Blastophagas issuing from the overwintering figs were lost, and, of course, in every subsequent generation the same thing occurred.

All of the profichi, or spring generation of figs, which had not been fertilized continued to drop from the trees until June 3, and on June 10 for the first time there appeared to be a swelling up or puffing up of what appeared to be the ripest fertilized figs of this generation. These ripest figs within twenty-four hours became softer and assumed the pale olive-green color so characteristic of the ripening mamme. The characteristics of this generation of figs in different stages of growth are worth especial mention. When quite small they are globular, pale green, and delicately pruinose. Just before fertilization they are bright green, shining, and long stemmed. After caprification some of them became gradually more rounded or even transversely oval, dark green, hard and firm, and very pruinose. Just before ripening, viz., just before the issuing of the insect, the ostiolum opens and gradually assumes a more decided yellow color, and shortly after the first issuing of the Blastophagas the outer layer of scales becomes erect and quite stiff. As soon as the first batch of Blastophagas issues, the figs commence to collapse and appear shriveled, but other insects continue to emerge for several days afterward.

THE SECOND GENERATION OF BLASTOPHAGAS.

Blastophagas began to issue on June 11. After that date the daily temperature increased, and the Blastophagas commenced to issue at an earlier hour every subsequent day, until on June 24 they began to issue at 6 o'clock in the morning. No Blastophaga was observed to issue in the afternoon or evening. A fig gives out insects only for a short time each day, commencing again the following day, and continuing for four or five days, and perhaps longer. The number of Blastophagas issuing from one fig each day is extremely variable, but reaches in some figs 50 or 60, perhaps more, which come out with a rush. The whole flight for each day does not last more than three or four hours, so that after 10 o'clock in the morning on June 24 very few specimens could be seen.

Although the issuing from the overwintering crop lasted over four or five weeks, fully 95 per cent of the profichi generation gave out all of their contained insects in two weeks.

CAPRIFICATION.

As soon as the first Blastophagas of the second generation were seen issuing on June 11, Mr. Schwarz commenced hand caprification, and succeeded in performing this function for about 20 trees. The next day a number of workmen joined him, and by June 15 and 16 a force of nine men was at work. The active work of caprification was carried on from the 11th to the 20th of June. It was early found that the estimate of 6,000 healthy profichi was altogether too small, and the entire force was kept very busy. An estimate was made that it would have taken at least seventeen men, working assiduously for a week, to caprify one-half of the orchard of approximately 4,000 trees, namely, ten men to do the picking and stringing, five to do the distributing and suspending, and two to carry the strung figs from headquarters to the distributers. The expense in wages for half the orchard would be in the neighborhood of $125.

The appliances necessary for caprification were found to be a number of stepladders, especially small ones; fruit baskets, or light boxes, for the collection of the figs; shallow wooden trays, into which the picked figs are laid for inspection; harness needles and raphia fiber, for stringing; scissors and sharp knives, for cutting the ends of the raphia; gasoline, for washing of the needles; a bucket of salt water, for the frequent washing of the hands; poles, short and long, for hanging the strings of caprifigs; hooks and crotches, to support the poles; flags, sticks, and labels, to mark the caprified areas on trees.

Finding only brief directions in the literature, Mr. Schwarz decided at first to devote 10 caprifigs to the average Smyrna tree, but the number was increased to 12, 14, 16, or even 20, wherever the trees were above the average in size. Recaprification with a smaller number of figs, varying from 2 to 10, was carried on at intervals of from three to five days, as far as the provision of profichi lasted. A second recaprification would be desirable; but for this purpose another variety of caprifigs, bearing either earlier or later figs, will be necessary. The system adopted was about as follows: At 6 o'clock in the morning all hands turned out and proceeded to pick over the caprifigs (either by hand or by pulling them off with a bamboo pole fruit picker), assembling finally at headquarters, where the figs were laid out in trays for inspection. This inspection was to eliminate the worthless figs, and to keep only those which were pretty sure to give out a good supply of insects. Doubtful ones were kept separate and were suspended on experimental trees. During this inspection the stringing of the figs began, and all hands joined in this tedious, dirty, and slow work. One or two figs at each end were strung with a strong needle upon a bit of the raphia fiber. After stringing 20 or 30 the needle and fingers become covered with the sticky, milk-like fluid which exudes from the stems, and the washing of fingers and needle becomes necessary. After stringing a couple of thousand of the figs each operator became aware that this milk possesses some poisonous quality. The tips of the fingers become sore and burn like fire. They aggravated this evil at first by washing the hands in concentrated salt water, so that they could proceed with the work only with considerable pain. The Japanese laborers simply rubbed their hands with dust, and probably this is the best way of getting temporarily rid of the milky stuff. Each string of raphia was then hung over a pole, which was suspended at some little distance from the stringers. The method of stringing and inspecting is illustrated in Fig. 3. After about 600 figs were strung the poles with their strings of figs were taken up, and the distributing party of five men started with the figs into the orchard, where the figs were suspended on the branches or wound about the twigs. This is illustrated in Fig. 4. Two rows of trees were thus caprified at a time, and the shaded portions of the trees were chosen. When the supply of figs was exhausted flags were planted on the row at the tree where the work stopped, and the distributers returned to headquarters to help the stringers until another batch was ready for distribution. In this large orchard the distributing party had to walk at least ten miles a day, each row being almost half a mile in length. The plan of throwing the strings into the trees was tried, but was not very successful.

In this way about 18,000 profichi figs were distributed, and more than 1,300 Smyrna trees were successfully caprified. Then also to the number of trees which were caprified by the transfer of figs must be added an unknown number of trees from which a crop of Smyrna figs was to be expected by the natural spread of the Blastophaga. At this time the loss of Blastophaga by spider webs was observed to be very great. Mr. Schwarz estimated that several hundred thousand specimens were lost in this way.

The effect of caprification on the young Smyrna figs becomes readily visible within a few days, and is illustrated by the figure of a twig at the lower left side of Fig. 5. Before the Blastophaga enters the fig the latter is transverse and strongly ribbed, as shown in the three figs on the right side of the twig. A few days after fertilization the fig swells up and becomes rounded and sleek, as shown by the two specimens on the left side of the twig. The figures along the right side of the plate represent (on a somewhat reduced scale) the "botanically" ripe Smyrna fig, the cut specimens showing that stage where the female flowers secrete the largest amount of saccharine matter.

The first figs were caprified on June 11, and the first ripe one dropped to the ground on August 2. By August 8 quite a number had dropped, but what may be termed real dropping did not begin until August 15, and ripening continued from that time on well into September, the whole period covering from four to five weeks. This gradual ripening is the most serious drawback, since the figs must be gathered every other day. This is an expensive affair in California, even with the cheap Chinese laborers employed.

HARVESTING AND DRYING.

As just stated, as the figs dropped they were collected every other day by laborers who went through the orchards provided with receptacles for collecting. This continued from August 8 for four or five weeks. No fertilized Smyrna figs were observed to drop to the ground prematurely. A great loss of insects, however, is occasioned by two or more (as many as five) Blastophagas entering the same fig, whereas only one is necessary for thorough fertilization. Another loss was from the Blastophagas entering the figs which were beyond the receptive stage, and which were found dead between the scales of the ostiolum. As the figs ripened another loss became apparent, many specimens turning orange yellow and a small area remaining hard and wrinkled. The bright orange color renders such figs easily recognizable, and if the defective spot is small, no great injury results. Moreover, during the expansion period of the figs many of them crack. The expansion due to the abundant secretion of saccharine matter is so powerful that the delicate skin of many figs, and, unfortunately, among the finest and largest, cannot stand it, and the fig splits in two, usually across the ostiolum. Sometimes it splits into three parts and opens like a rose. If the split does not extend very far the fig is not rendered worthless, but if it extends across the surface the fig is lost. The loss caused by birds is also very great, especially by the California house finch or linnet (*Carpodacus mexicanus obscurus*). Mr. Schwarz found that these birds never nest on the fig trees, but on the shade trees along the roads, on the garden trees in the vicinity, and on the willows and cottonwoods along the ditches. They do not fly far away from their nesting places, and there was consequently little damage done in the central part of the fig orchard. Along the borders, however, hardly a single good fig was harvested on account of these birds. He advises, therefore, that a Smyrna fig orchard should not be planted in the vicinity of large shade trees or orange groves. Souring of the figs was not noticed in the early part of the season but began later to a limited extent when showers occurred. When the Smyrna figs ripen the ostiolum opens wide and remains open so that a match can easily be inserted, and often moderate-sized insects can enter and feed on the sugar. Some of them are caught in the sticky sap and die within the fig. When the figs are ripe and fall, ants and beetles of the genera Notoxus and Carpophilus enter in this way. Wasps and other insects, notably among them a species of Blapstinus, eat holes through the skin if the figs are allowed to remain on the ground longer than a day or two.

On account of these and other losses, only about one-half of the crop of Smyrna figs was gathered this year in Mr. Roeding's orchard. The entire crop was estimated by Mr. Schwarz at from 12 to 15 tons of good figs on the trees, all resulting from the inhabitants of less than 450 winter figs.

It may also be of interest to state that the second crop of the San Pedro figs has been successfully caprificated by the Blastophaga.

After the collection of the figs they were transferred to the drying ground, dipped into a boiling brine made by dissolving 3 ounces of salt to a gallon of water, and then placed on trays, the time of drying varying from two to four days, according to the weather. The dipping of the fig is supposed to bring the sugar into the skin, hasten the drying, and make the skin pliable. After the figs were dried they were placed in sweat boxes holding about 200 pounds each, where they were allowed to remain for two weeks, to pass through a sweat. The only other treatment they received before packing was to wash them in cold salt water, for the purpose of removing all dirt, and figs which were overdried or improperly fertilized (called "dummies" by Mr. Roeding) rose to the top when placed in the solution.

LIFE HISTORY OF BLASTOPHAGA.

So far, we have referred to the life history of the fig-caprifying insect only in the most general terms. The illustration (Fig. 6) which is given of the insect

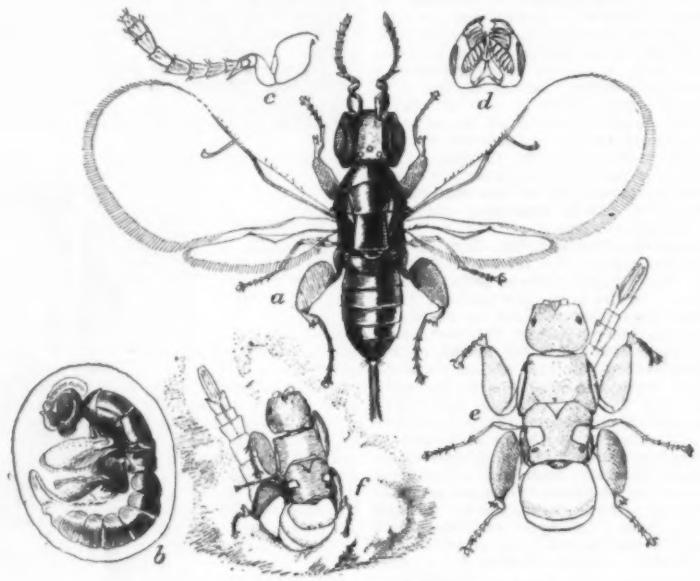


FIG. 6.—BLASTOPHAGA GROSSORUM.

a, adult female with wings extended, seen from above; *b*, female not yet entirely issued from pupal skin and still contained in gall; *c*, antenna of female; *d*, head of female from below; *e*, adult male; *f*, the same—all greatly enlarged (original).

* Mr. Schwarz subsequently decided that this disease is due to the presence of female flowers.

in the early part of this article is a copy of an old one drawn by the famous English entomologist, Prof. J. O. Westwood, and which was published in the Transactions of the Entomological Society of London, 1882, Plate IV., in part. It is an interesting figure, and illustrates rather well the difference between the male and the female. It shows the peculiar mouth parts of the female, which enables her to gnaw her way through the tough seed-like gall, and shows also the male in the act of fertilizing the female and the female in the act of issuing from the gall. It is, however, incorrect in some of the rather important structural details. The entomologist will at once note especially the difference in the details of the thorax in both males and females, and especially will the difference in the length of the abdomen of the male be seen.

The male is always wingless. It has no ocelli, and its compound eyes are greatly reduced in size. The fact that the male rarely leaves the fig in which it has hatched might almost be inferred from these facts of winglessness and partial blindness. When this wingless male issues from the seed-like gall in which it is contained, it seeks a female gall in the interior of the same fig, gnaws a small hole through its cortex, inserts its extremely long, almost telescopic, abdominal extremity through the hole, and fertilizes the female. The female subsequently, with her powerful jaws, gnaws the top of the gall off and emerges, crawling around the interior of the fig and eventually forcing her way through the ostiolum, almost immediately seeking for young figs, which she enters, and should the fig entered prove to be a caprifig, lays her eggs at the base of as many male flowers as she can find, and then dies. Should the fig entered, however, be a Smyrna fig, either through the fact of the caprifig from which she issued having been hung in the branches of a Smyrna fig tree, or from the fact that she has flown to an adjoining Smyrna fig tree, she walks around among the female flowers seeking for a proper place to oviposit, discovering eventually that she has made a mistake, but, nevertheless, probably trying to find a proper place for oviposition by thrusting her ovipositor in here and there. It is this futile, wandering search, covered as her body is with pollen from the caprifigs, that produces the extensive and almost perfect fertilization of the entire number of female flowers.

THE EGG.

The egg when seen in the ovary is very long and slender, but when found in the fig it is less than three times as long as broad, almost regularly elliptical in shape, white and slightly shining, with a delicate petiole of about one and a half times its length. On dissecting a male flower into which the egg has been inserted by the female Blastophaga, it will be found to have been pushed in transversely to the axis of the flower nearly to the center, with the petiole reaching out to the cortex. Its dimensions are, length, exclusive of petiole, 0.092 mm.; width, 0.046 mm.

THE LARVA.

The young larva is a delicate little creature curved upon itself and showing no visible segmentation. It takes many days' development of the caprifig before the larva becomes visible with certainty without the most careful observation under a strong lens. The first sign which indicates that one is watching the larva and not the sap in the gall is the visibility of two brownish spots, which are without doubt the mandibles of the larva. When these spots become visible, with a very powerful hand lens (one-fourth inch Tolles triplet), the larva is more than two-thirds grown and the segmentation of the body has become noticeable. It is a very difficult thing to dissect the larva out of the gall without crushing it, but it can be accomplished with care by the aid of dissecting needles. No casting of the skin has been observed. With the growth of the larva the gall at the base of the male florets becomes hard, and greatly resembles a seed, turning light brown in color.

THE PUPA.

The male and the female pupæ each occupies a greater portion of the interior of the gall.

DURATION OF THE EARLY STAGES.

This is a point upon which it is very difficult to secure exact data. The duration of a generation, excepting, of course, the hibernating generation, seems to average between sixty and sixty-eight days, say, sixty-four days. It seems certain that more than fifty days are given to the larval stage. Oviposition takes two days, or perhaps longer, and the last larval stage with the pupa stage, and what may be termed the immature imago stage, lasts only a few days. All of the long intermediate period is occupied by the immature larval stages unless there should prove to be a prolonged egg state, which is very improbable. These three stages seem parallel by the three outwardly visible changes undergone by the fig, and which have been described in preceding paragraphs. The first swelling of a freshly stung fig, about four days after the entering of the insect, probably marks the hatching of the egg. The long intermediate stage of slow almost imperceptible growth is identical with the duration of the larval stage, and includes also the pupal stage. The final and sudden expansion of the fig always marks the issuing from the galls (but not from the fig) of the male imagos. In the hibernating generation the duration of the final stage is greatly prolonged. On March 15 Mr. Schwarz found the insect in fallen overwintering figs as larva, pupa, immature imagos, and occasionally mature male imagos, and this lasted until March 28 or later. The same state of affairs was found in figs sent to the writer by Mr. Roeding as early as February. It seems probable that before a sudden drop in temperature occurred at any time subsequent to the middle of October the insect would hibernate in all of the different stages in which it might happen to be at the time, because it is the presence of the insect which makes the fig adhere to the branch during the winter.

MOND GAS.

THE prominence which in current technical and commercial literature has been given to the plans of the promoters of the Mond gas development, and the great expectations of industrial advancement of which such plans are the somewhat unsubstantial basis, will give interest to a brief discussion of the subject in view of recent Parliamentary action.

Considered in the light of its chemical composition, the Mond gas does not seem to be an improvement upon what has gone before it. The following is given on good authority as its average composition:

Hydrogen	24.8
Marsh gas	2.3
Carbon monoxide	13.2
Carbon dioxide	12.9
Nitrogen	46.8
Total	100.0

A gas of this composition is only about 40.3 combustible, and has a calorific value not greater than 154.6 B. T. units per cubic foot. It is difficult at this distance to see why it should have created any excitement as a discovery of great value in this department of industrial chemistry. The Dowson gas is well known, and probably familiar to every gas consumer on a large scale, as it has been widely advertised in connection with tests of gas engines. Its average composition is as follows:

Hydrogen	19.8
Marsh gas	1.3
Carbon monoxide	23.8
Carbon dioxide	6.3
Nitrogen	48.8
Total	100.0

This composition contains 44.9 per cent of combustible, or nearly 10 per cent more than the Mond gas, and has a calorific value of 164 B. T. units per cubic foot. Both gases are of low efficiency and have a fuel value so small that they must be distributed with an economy which would seem to be impossible to compete with coal. That they are cheap to produce per unit of value is probably true, but as both contain some 60 per cent of useless matter it follows that in distribution 60 per cent of capacity of holders and conduits will be unproductive of returns on the capital which has to be invested in them. Experience has shown that in the case of a diluent like nitrogen it is cheaper to add it at the point of consumption than to transport it in original admixture.

The *raison d'être* of the Mond process is said to be the production of fuel and power gas at a very low price, as a practical economy to fuel consumers. The process of its manufacture is substantially as follows: Bituminous coal slack is charged from hoppers holding about half a ton into the long bell of producers, where preliminary carbonization takes place. This is a distilling process and gives a crude retort coal gas. Steam and air are then passed through the mass of incandescent coke, giving, as long as the temperature remains high enough to decompose the vapor of water, a crude water gas from the steam and a crude and extremely lean producer gas from the air. The hot gases are drawn off through a recuperator, where they heat the incoming air blast. From this they are passed to a washer and cooled to about 194 deg. F. They next pass into a lead-lined tower filled with tiles, over which drips acid liquor carrying about 4 per cent excess of sulphuric acid. The gas next goes to a cooling tower, where a descending spray of cold water condenses the steam; thence to still another tower, where it is further cooled by giving up its heat to the air constituting the blast. The object of this preheating of the blast is to enable the air to take up moisture until the point of saturation is reached. This, in substance, is the process as described by Herbert A. Humphreys in a paper before the British Institution of Mechanical Engineers. No doubt its details have been well considered, but in view of the results attained it does not seem calculated to excite any exuberance of enthusiasm among gas experts. The claims of the inventor to a bonanza in his method are based upon the expectation of extracting and recovering all the ammonia sulphate, of which it is expected a ton of slack will give nearly a hundredweight, or about four times as much as is ordinarily recovered in the manufacture of retort gas. It is expected that the ammonia will offset the cost of the coal. With this in view it requires no exceptional elasticity of the imagination to discover that the gas will "cost nothing" to make; but the fact is conveniently overlooked that a speculation based on the continuing stability of the value of sulphate of ammonia with five Mond gas plants in operation possesses a large element of uncertainty in which the chances would seem to be all against the speculator taking the risk. However, it seems to be unusually attractive. Parliament, on a favorable report of a committee of the House of Commons, has approved the application for the incorporation of a company with $5,000,000 capital to supply fuel gas to a district west of Birmingham, now containing 18 gas companies with plants in operation. It is part of the programme of the company to sell gas as low as 4 cents per thousand, and their charter powers limit them to 8 cents as a maximum. This, of course, would not be compensatory. They expect, however, to make so much money on ammonia sulphate and to produce so cheaply that they will be able to earn satisfactory dividends on the capital invested—a hope not fully warranted by any results thus far established by theoretical calculations.

It is impossible to resist the conclusion that the objective of the promoters of the Mond scheme is financial rather than industrial. There is really nothing to warrant confidence in the ability of the company to store and distribute their gas at the price proposed—or, indeed, at any price, considering its quality, which will permit it to enter into competition with coal for the only purposes for which it is claimed to be adapted. A lighting scheme may be concealed behind the undertaking, which would involve a material change in the process from that described, but in a consideration of the matter from the standpoint of the industrial value of the new gas we do not feel at liberty to take this into account. The field of usefulness of the fuel gas is restricted at both extremes. Small consumers cannot afford to use it, even at the low price named, and if they could their custom would not pay the producers. On the other hand, the large consumer who would find gas economical can better afford to install a plant of his own, which he can do under any one of a dozen systems, and make his own gas for anywhere from 0.7 to 1 cent per thousand, than buy it in a large way from 4 to 8 cents per thousand.

The Mond process may or may not be highly economical and advantageous, but it is impossible to see that it offers any opportunity for profitable installation on the plan proposed. The fact that it will cost as much to distribute it as it would to distribute gas of much higher quality and much greater calorific value predooms it to an unsuccessful issue. Gratuitous advice is rarely welcome and still more rarely useful to the recipient; but we cannot resist the temptation to point out that what would seem to be the most profitable development of the Mond process would be to establish plants at the pit mouth, under the best practicable arrangements as to supplies of culm, make the gas, use it on the ground to drive powerful groups of gas engines coupled to dynamos and distribute electricity in currents of great volume and high tension for all purposes demanding power. The areas of convenient and economical distribution of such currents are steadily widening. It is no longer difficult to send them by practicable conductors from 60 to 100 miles in any direction. Not only is the cost of conductors very much less than that involved in the construction of mains large enough to convey great volumes of low gas, but the leakage loss is very much less. The only uses in which electricity cannot compete with coal are those in which gas would be at a still greater disadvantage. This, however, is not at all what the Mond Company propose. A well-informed correspondent of the Gas Light Journal, writing from Salisbury, says:

"The cost of the plant required to carry out the scheme now in view would be, in round figures, £800,000, and when in full operation the daily output would be 84,000,000 cubic feet. The gas is, practically, attenuated coal gas, the diluents being nitrogen and carbonic acid, and it is to be sold at 2 pence to large and 4 pence to small consumers. This seems a whimsical distinction that in practice would be attended with much difficulty in the case of users whose consumption flickered under and over the border line. The terms small and large are used in a very different sense to that current among gas companies. We should call a user of 1,000,000 per annum a large consumer. But in regard to producer gas, even if in the Mond district he was a small consumer, the cash value of his custom would be only £17 per annum. So that a great deal turns upon whether we consider the quantity of gas taken or the cash value of the transaction. With such a cheap article statistics based upon the quantity sold are apt to be delusive and admit of a very extensive showing on a very small foundation, just as electricians, by selecting a small unit, the 8-candle lamp, as a means of expressing their working results, are able to make a very imposing front for a small business. A company who claim to supply over 10,000 lamps may have a gross income of £2,000 or less. So it is better to go straight to the cash returns, and on this head the Mond company, when in full operation, look for a revenue of £210,000 from sales of gas and for a net profit of £125,000, or about 15 per cent. So they evidently are looking forward to good times."

It is quite possible, as we have suggested, that behind the Mond gas undertaking lies a purpose broader and more promising to the shareholders than can be discovered in the plan as announced. This is the more probable for the reason that under present conditions the English capitalist is not chasing moonbeams to any great extent. What this purpose may be we frankly do not know, and it does not devolve upon us to inquire. The interest of the subject for the American reader is limited to the economic aspects of the claim that the company will cheapen production in every line of industry within the sphere of their beneficent operations by making one ton of coal do the work of five now burned under boilers.—The Iron Age.

WATERPROOF BLUEPRINTS.

Written for Mines and Minerals by A. B. JESSUP.

THOSE who have experienced the annoyance of having blueprints discolored and blurred by rain, droppers in mines, and moisture in general, will appreciate a simple and inexpensive method of waterproofing the prints which renders them completely impervious to weather and water. The waterproofing medium is refined paraffin, and may be applied by immersing the print in the melted wax, or more conveniently as follows: Immerse in melted paraffin until saturated a number of pieces of an absorbent cloth a foot or more square, and when withdrawn and cooled they are ready for use at any time. To apply to a blueprint, spread one of the saturated cloths on a smooth surface, place the dry print on it with a second waxed cloth on top and iron with a moderately hot flat-iron. The paper immediately absorbs paraffin until saturated and becomes translucent and highly waterproof. The lines of the print are intensified by the process and there is no shrinking or distortion. As the wax is withdrawn from the cloths more can be added by melting small pieces directly under the hot iron. By immersing the print in a bath of melted paraffin the process is hastened, but the ironing is necessary to remove the surplus wax from the surface, unless the paper is to be directly exposed to the weather and not to be handled. The irons can be heated in most offices by gas or over a lamp, and a supply of saturated cloths obviates the necessity of the bath.

This process, which was originally applied to blueprints to be carried by the engineer corps in wet mines, is equally applicable to any kind of paper, and is convenient for waterproofing typewritten or other notices to be posted up and exposed to the weather.

THE ASPHALTS OF PONT-DU-CHATEAU, AUVERGNE.

THE bituminous deposits of Limagne, in Auvergne, distributed between Clermont-Ferrand, Riom and Allier, over an area of about nine miles square, have attracted attention for a long time, and the first concession was made as long ago as 1829 at Escourchache, in the Commune of Chamalieres, near Clermont. Afterward, in 1843, were made the concessions of Lussat, Malintrat, Pont-du-Chateau, Puy de la Bourriere, and Roys, within a zone of about three miles in width, parallel with Allier, and upon which all the present work is being done.

In 1863 two new concessions were made more to the north, near Riom, at Macholles and Cœur, but these, up to the present, have remained unexploited. Finally, in 1874, after various vicissitudes, all the concessions of Lussat, Malintrat, Pont-du-Chateau, Puy de la Bourriere, and Roys were combined by the Société des Bitumes, at Asphaltes du Centre, which in recent years has gradually developed its production in confining its work to the mine of Pont-du-Chateau, in the vicinity of which it has erected works at the point where the Clermont-Thiers railway traverses Allier. The exploitation of Lussat has been suspended since 1885, and that of Malintrat, it seems, is going to be resumed. In addition to these deposits of asphalt, exudations of bitumen are known to occur at Puy de la Poix, two and a half miles east of Clermont.

All these interesting manifestations have in recent years led to the making of soundings in order to ascertain whether these hydrocarbons are not derived from deep-seated petroliferous strata. An unsuccessful sounding was made to the north of Riom, near Cellule. Another sounding was made to the south of Riom at Macholles to a depth of 3,300 feet, without getting beyond the tertiary marls, and produced a few petroliferous exudations interesting solely from a geological view point.

Upon the whole, the work is at present concentrated at Pont-du-Chateau, which, in 1890, manufactured from six to seven thousand merctantile products, and is now manufacturing more than twelve thousand, in the form of bituminous cement and agglomerated asphalt bricks employed in the same way as blocks of wood for the paving of streets. This latter branch of manufacture was organized as long ago as 1895. Besides, a little bitumen, properly so called, is sold for caoutchoucs, varnishes, etc. If, in the first place, we examine the geological side of this small industry, before discussing the practical application, we shall see that all the bituminous deposits of Auvergne are (for some reason or other that cannot as yet be explained) concentrated in the region of the most recent basaltic manifestations, in which carbon is found likewise in the ground in another form—that of carbonic acid, brought to the surface from all sides by thermal springs.

These bituminous impregnations have been observed in the most diverse soils—felspathic, loamy, basaltic, calcareous, etc.; but clay, according to a saying of miners, is the great enemy of bitumen, and the latter constitutes in reality a truly utilizable substance only when it has become impregnated uniformly throughout its entire mass, with non-argillaceous, non-marly, and non-silicious limestone, which then forms mineral pitch, properly so called. This is the substance which it remains to submit to a special preparation in order to convert it, according to the purpose for which it is designed, into asphalt powder, for compression (for roadbeds) into bituminous cement (for sidewalks) or into agglomerated bricks.

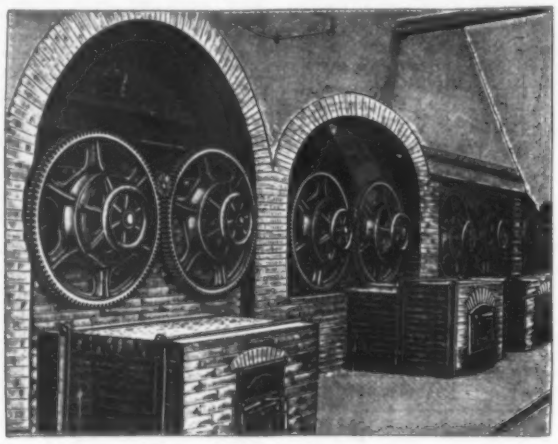


FIG. 1.—BOILERS FOR BITUMINOUS CEMENT.

One of the great curiosities of the asphalt mine of Pont-du-Chateau is the manner in which the bitumen superabounds there along two great fissures with which its geological advent seems to be connected, and starting from which the bituminous impregnation gradually decreases in intensity in measure as the distance therefrom increases. Along these fissures there ascend from the ground genuine springs of bitumen that form a black brook along the galleries and exude through all the pores o the tertiary limestone. The spaces left by the shells of *Helix Ramondi*, which is very frequent in this limestone, are often filled with this bitumen. Upon visiting this mine, one walks over these scarcely solidified black brooks, to which it suffices to apply a light in order to produce slight explosions due to the ignition of the escaping hydrocarbureted gases.

The limestone thoroughly impregnated with bitumen, or natural asphalt, extracted from the mine, must, before being used, undergo various manipulations, which, at Pont-du-Chateau, are effected in a small establishment which employs 150 horse power The two products obtained here are bituminous cement and paving material of compressed asphalt.

In order to obtain the bituminous cement employed for the sidewalks of large cities, it is necessary to melt pulverized natural asphalt with the addition of pure bitumen, in such a way as to obtain in the product a proportion of about 18 per cent of bitumen, which permits of the addition of gravel at the moment of using. The preparation is made in twelve horizontal mixing boilers, capable of producing 30 tons a day, and of which Fig. 1 gives the type. Into these is introduced the most inferior crude material along with Cuban or Trinidad bitumen. The whole is mixed during the heating and the product is molded into 55-pound disks about 10 inches in diameter and about 2.5 inches in thickness. This cement, later on, has to be remelted with 5 per cent of Trinidad bitumen and 68 per cent of gravel in order to be spread in layers, which are generally from 6 to 8 inches in thickness.

The compressed asphalt paving material manufactured at Pont-du-Chateau is designed to replace the powdered asphalt compressed by ramming or rolling while hot. Its mode of application resembles that of wood paving (which, in recent years, has offered a strong competition to asphalt); that is to say, it suffices to lay the blocks side by side upon a 3-inch bed of concrete, and then, with a broom, to spread over the surface a layer of lime in order to fill the interstices.

In order to obtain these agglomerated bricks or blocks, the powder of natural asphalt is first heated to about 120 deg. in roasters (six in number) having a continuous rotary motion (Fig. 2).

As the difficulty of such manufacture is to obtain a very homogeneous product, there are selected for this purpose the very best materials, those in which the black bitumen is not visible, but, on the contrary, is well incorporated with the limestone in the form of a soft rock of a chocolate brown color. The roasting, which is quite difficult to effect, must expel the water and the light oils by distributing throughout the mass a very uniform and not locally exaggerated heat. After this, the powder is compressed by means of hydraulic presses in apparatus analogous to those used for making briquettes of coal (Fig. 3). Three pressure accumulators actuate the six hydraulic presses, which give about 30 tons of the product a day. Here again some dexterity has to be employed in order to prevent bubbles. These, when they exist, do not appear at the surface (which has always a well-compressed appearance), but within, and cause the block to break when used. The compressing must therefore be done in such a way as to expel all the imprisoned air progressively.

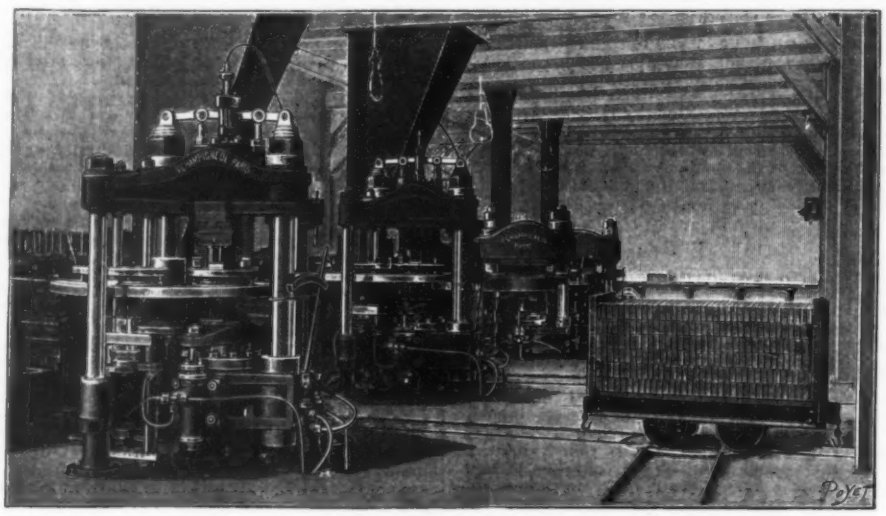


FIG. 3.—HYDRAULIC PRESS FOR MAKING PAVEMENT BLOCKS.

Finally, there are obtained genuine bricks of from 1 to 2 inches in thickness, or thinner flags, which, upon coming from the press, are brown, but become rapidly whitish gray in the sun. Their density is about 2.2. According to the inventors, they possess the advantage of having undergone a pressure of 11,440 pounds to the square inch, while by ramming by hand, scarcely 570 pounds are reached. It may be added that, according to the climate of the country in which they are to be used, the proportion of bitmuen is varied between 12, 10, or 8 per cent.—For the above particulars and the engravings we are indebted to La Nature.

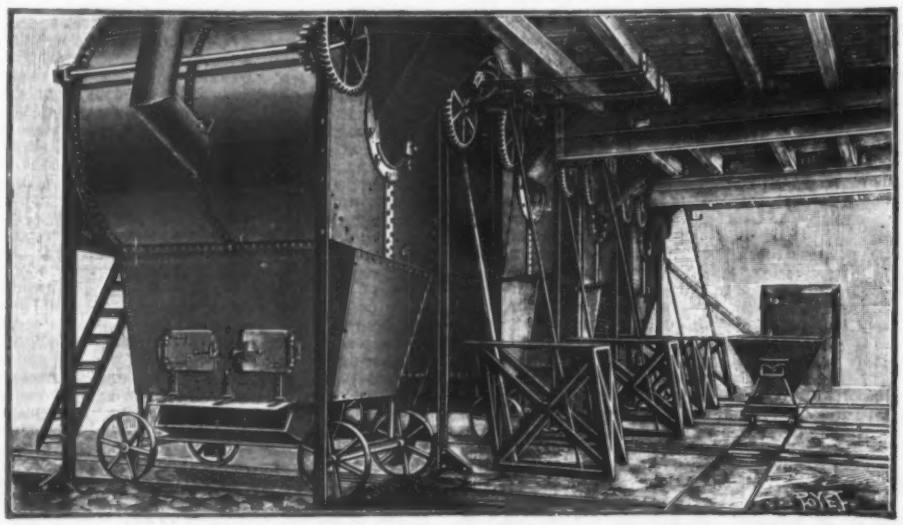


FIG. 2.—ROTATORS FOR HEATING POWDERED ASPHALT FOR PAVEMENTS.

MANUFACTURE OF SOAP IN THE PHILIPPINES FROM THE FAT OF THE CARIBOO.

IT might be quite profitable for some of the French manufacturers, expert in the production, to establish soap factories in the Philippines, where processes are at present rudimentary. The output might be disposed of in the islands or for export to the United States or elsewhere as affairs assume a settled state; or the fat might be sent to Europe to be converted into soap.

The cariboo is an animal that can be raised for food or used as a beast of burden. The flesh is not as delicate and succulent as that of the ox, but the natives are well satisfied with it. As a beast of burden his services are valuable. The cariboo are employed to transport burdens on the back in pack saddles, or to draw carts of primitive construction or drag a kind of sledge. They also serve as motive power in numerous sugar cane establishments. The machinery requisite might also be worked usefully and economically for making the soap for which the animal has furnished the principal material. He offers a considerable ad-

vantage over the draught animals in drawing easily and with great docility whatever is attached to him. This he does without any drawback in cases where mules, horses and oxen would prove rebellious.

Thus, where steam or hydraulic power cannot be economically utilized, two or three of these beasts would supply advantageously all the motive force needed for this manufacture; while the numerous herds would furnish the fat, without counting subproducts, not now rendered available by the natives.

They are raised by the natives and allowed to roam in a wild state in considerable herds, the breeders taking for service or for slaughter only those they deem the most suitable. The rest, in so fertile a country, find abundant nourishment, and fatten, left to themselves, so that the proportion of grease furnished, compared with the whole weight, is considerable; and as they can be bought at low prices, the yield would be profitable.

There is one factory at Manila, one at Iloilo, and a few others along the coasts. Soap is also made by the inhabitants in the native villages for their own wants, but the waste from the primitive methods made use of shows the necessity of more rational and regular processes.

One of the principal advantages would lie not only in the cheapness of the material, but in the low price of labor. The transportation from the interior is inexpensive. The exportation would be advantageous whether of the crude fat, or crude soap, or finished soaps, both fine and ordinary, especially to nearby countries, as Japan and certain parts of China, where there is a great demand.—Translated from Les Corps Gras Industriels.

CEMENTS.

By WILLETT C. PIERSON.

WHAT will be the future of Portland cements and natural cements? In how many new ways will this material be utilized? Not long ago we read that Thomas A. Edison had discovered a process of building houses at an extremely low cost, and his method was the "pouring on" of concrete, which will take but a few days when the house will be habitable. Even the inside work and roof will consist of cement. It seems infallible that such an undertaking will be a success and the cement remain intact.

Wood has been so treated that it can be made fireproof, and is now used in the high buildings in New York city and on vessels. A test was made at the Stevens Institute of Technology, Hoboken, N. J., upon the wood, which at very high temperature would only char—it was impossible to burn it.

If Portland cement is used for sidewalks, why not make roads of it? It has been tried on a small scale and proved successful, but the objections arise in the cost and durability of the cement in comparison with asphalt.

There are many instances where asphalt has fissured and disintegrated, and especially in the summer it has a tendency to soften and run.

As cement hardens and grows stronger by age, it would be difficult, should the sewer, gas and water pipes be laid underneath, to reach them; where in asphalt pavements it is taken out in blocks. To remedy this the pipes should be laid in the space between the sidewalk and gutter—this same space is made use of in the city of Rochester for trolley lines and tracks.

Compare the American natural cements, which may be divided into three classes—magnesium cements (Rosendale cements), natural Portland, and aluminous cements—with the American Portland cement, and what is the demand to-day? What do the engineers and architects specify? The American Portland.

The work which has been done with the natural cements is beyond comprehension. They have been used in large buildings, tunnels, dams, bridges, etc., and there has not been a failure recorded. Over 100,000,000 barrels have been used in the past ten years. Then if you consider the consumption of the German Portland cement (which in the year 1891 was 2,988,313 barrels; of the American Portland, 454,813 barrels; in 1899, 5,146,064 barrels American Portland, 2,269,023 barrels German Portland) you will find a great falling off. At the present day only a few thousand are imported, while the sales of the American Portland reach the high-water mark.

True, the American Portland has many advantages over the natural cement, in its color, tensile strength, fineness, setting qualities, uniformity, etc.

For sidewalk construction the color of the Portland reaches very near the true stone, being bluish-gray in color and crystalline in texture, which results from the burning at high temperature.

Rosendale is not subjected to great heat, its color is darker, and in brickwork and masonry, on account of its excess of magnesia, it shows white streaks and liable to affect the brick. On account of under-burning the natural cements have less combining power with sand. The one to one natural is not as strong as the two to one Portland, using about 15 per cent of water.

Cements showing at seven days' test a high tensile strain neat per square inch of 450 to 600 pounds are apt to show no ultimate gain in long periods, while in those testing as low as 250 to 350 pounds for seven days, the highest gains are noticeable.

A sample of specification of tensile strength per square inch calls for neat cement as follows:

	Natural. lbs.	Portland. lbs.
One day - till set in air, remainder of time in water...	60	150
One week—One day in air, six days in water.....	150	400

Specifications for fineness:

	Natural. Per cent.	Portland. Per cent.
No. 50 Sieve - 50 Meshes per lineal inch, ...	90	98
" 100 " —100 " " " .... —		90

Diameter of wire for No. 50 sieve, No. 35 Stubs' wire gage.

No. 100 sieve, No. 40 Stubs' wire gage.

Finely ground cement if mixed neat will not give as good results as one more coarsely ground; but when mixed with sand, the fine-ground will surpass the coarsely ground.

The setting of cement is a chemical operation; for the finer ground the cement, the more active the particles, and therefore the quicker the setting when the hydration by the addition of water goes on.

Greater care is taken with a Portland cement, chemical tests and analysis being made from each hour's and day's output, thus securing a uniform product, while tests made upon natural cement are mostly confined to fineness and tensile strength.

One writer has justly said that the literature of cement is a minimum quantity and so technical in character as to render its wide dissemination a matter of slow progress.

THE LIGHTHOUSE DEPOT OF FRANCE.

THERE exists at Paris a very curious establishment, situated upon the hill of the Trocadero. We refer to the lighthouse depot of France. This depot, in bygone days, formed an integral part of the gardens of the Trocadero, and it was due to this fact that there was obtained the "right of view." This advantage permitted, and still permits, of preventing the construction, within a certain radius, of houses of such a height as to obstruct the luminous rays emitted by a lantern placed in the central tower. The project of moving the depot to another locality, mentioned some time ago by the daily press, will probably never be carried out. No matter what might be the site selected in Paris, it would be necessary to institute *expropriation* proceedings in order to obtain the "right of view"; and the cost of this would amount to more than the sum that would be yielded by the sale of the land now occupied. On the other hand, it is necessary that the lighthouse depot shall be at Paris, and not in some seaboard city or other, since it is at Paris alone that are discussed all interests relating to maritime lighting.

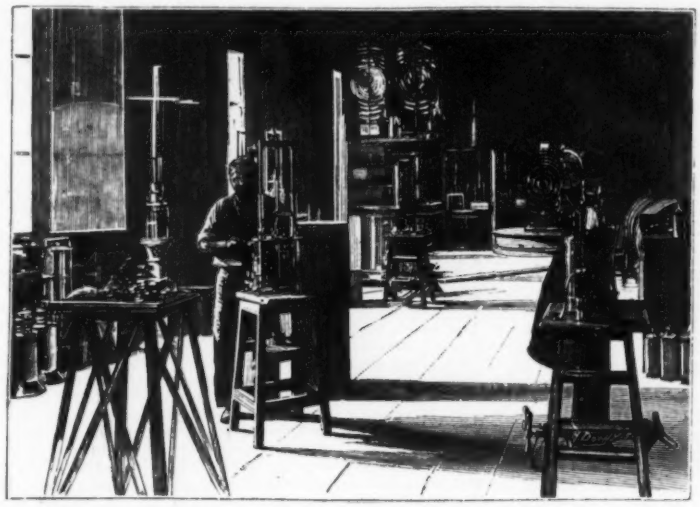
The fact is so well understood in high places that it is now probable that nothing will be expropriated but the land occupied by the yards of the Ponts et Chaussées, and an old two-story dwelling of M. Bourdelles, and the gardens adjoining it. The rest will remain, for the lighthouse depot really occupies but little space.

In the building itself, which comprises only a ground floor and one story above, with a central tower for the testing of lights over Paris, everything is devoted to the study of lighthouses. In the first place, we have the laboratory, or experimental hall, in which the various types of lights are experimented with. At present, observations are in progress upon a kerosene lamp, with interrupting screens, which, without refilling, is to produce a continuous light automatically for a hundred and fifty days—say, nearly half a year. The whole is provided with an electric regulator that operates by means of batteries. Farther along may be seen more or less complicated electric lamps.

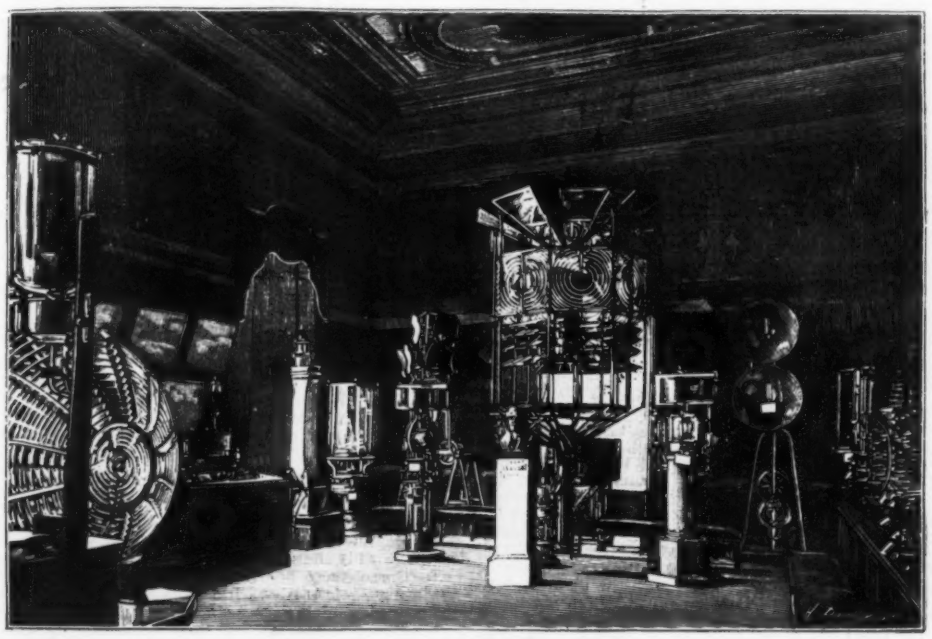
The hall alongside of the laboratory has been converted into a museum. Here are brought together many interesting pieces which it would take too long to describe in detail. Let us be content to compare the first revolving lamp, put in service in the Ailly lighthouse in 1781, the first of the kind with spherical reflectors and flat wick, with the modern oil-gas incandescent lamp, a model of which, designed for Cape Bear, figured at the recent exposition. A simple glance at the two lamps suffices to show the long stride that the art of lighting the seacoast has made in a little more than a century.

It is not only in lighting, but also in the number of lighthouses established that progress has been incessant. In the hall of the Lighthouse Commission, a little above a huge round table, and quite near a bust of the great scientist, Fresnel, there hangs upon the wall a large map of the globe, upon which are represented the various lighthouses of the world, in white dots that vary in size according to the power of the lamps. This map was prepared in 1867, but if it were to be revised at the present time, the number of beacons represented would have to be doubled.

Alongside of the hall just mentioned there has recently been installed an apparatus for the transmission of messages by wireless telegraphy.—For the above particulars and the engravings we are indebted to Le Monde Illustré.



A WORKSHOP AT THE LIGHTHOUSE DEPOT OF PARIS.



THE MUSEUM OF LIGHTHOUSES AT PARIS.

THE COST OF CRIME.

MR. EUGENE SMITH, of New York, read a paper with the above title before the annual meeting of the National Prison Association, held at Cleveland, O., in 1900, in which the question is reviewed chiefly from a monetary standpoint. Few persons grasp the significance and the far-reaching importance of crime regarded from any point of view; and although it may appear somewhat sordid to endeavor to arouse the interest of the general public in the subject from the pecuniary aspect, yet after all this is the phase of the matter which will appeal most closely to the ordinary individual. The science of penology has advanced, and the treatment of criminals is conducted upon much more intelligent and humane lines than ever before; but, notwithstanding this fact, the large mass of the population exhibits an apathetic indifference with regard to the system, and refuses to be instructed. Ac-

cording to Mr. Smith there are several explanations of this popular indifference. The mistaken belief that the subject is abstruse and beyond comprehension; incredulity as to the possibility of reforming criminals; aversion to the criminal as an enemy of mankind beyond the pale of sympathy; the idea that repression of crime is a function of government and outside the scope of individual responsibility—all these causes contribute to lead the public to dismiss the whole subject in favor of other matters believed to be more important.

The controlling cause, however, of the popular indifference, beyond all of those already mentioned, is the utter failure of the public to grasp the importance of the subject and to comprehend how enormous is the burden and how terrific the danger with which crime oppresses the world. It is therefore thought that if an estimate as approximate as possible is made of the cost of crime in dollars and cents, and if the general population is by these means impressed with a clear conviction that it is a question which closely concerns their own pockets, this apathy may give place to a practical interest. Of course to say unhesitatingly what share of public taxation is properly chargeable to crime is wholly impracticable, as crime exerts its influence to a greater or less extent upon every department of life.

Mr. Smith thinks the most hopeful method of reaching a near estimate to be that of analyzing the statistics of certain cities or towns where the figures are known to be accurate and complete; and when definite conclusions have been drawn from them, it may reasonably be inferred that the same conclusions apply to other cities and towns similarly situated. For this purpose typical cities, widely separate from each other, and each one the central point of a large section of country of which it is fairly representative, have been selected, such as New York, Cleveland, Chicago, St. Louis, San Francisco, Richmond, Charleston, Savannah, and New Orleans.

The general result of an analysis of the fiscal reports of these cities is as follows: The cost of crime included in taxation in the city of New York gives an average charge of over $6 for each individual in its population; in San Francisco about $5; in the other cities named the per capita tax runs with slight variation from $3 to $3.50, including county taxation, $4 to $4.50 for each inhabitant. The final computation of the annual cost of crime taxation in the United States is placed at the conservative figures given below: City and county taxation chargeable to crime: 30,000,000 inhabitants of cities at per capita rate of $35, $105,000,000. Town and county taxation chargeable to crime: 45,000,000 inhabitants of the open country at per capita rate of $1, $45,000,000. Federal and State taxation chargeable to crime: not less than $50,000,000. Total, $200,000,000. This sum, immense as it is, merely represents an outlay in the prevention of crime. Mr. Smith further estimates the annual income of criminals to average $400,000,000, which, added to the yearly taxation caused by crime, gives a total of $600,000,000. This amount almost makes the head reel, and should have the effect of convincing unthinking members of the community that it would be well if they were to insist upon prison reforms and upon the abolition of methods and abuses existing in many parts of the United States. We shall have criminals always with us, as we have the poor, but at the same time there can be no doubt that many sinners may be reclaimed from a life of crime by treatment conducted on scientific principles.—New York Medical Record.

GLUCOSIDE CHARACTERIZING THE GERMINATIVE PERIOD OF THE BEECH.*

By M. P. TAILLEUR.

WHEN the hypocotyledonous axis of a beech in germination is crushed, the odor of wintergreen essence is perceived. This essence consists almost entirely of methyl-salicylic ether. It is known that, to obtain it, it is distilled in water from the stems and leaves of the *Gaultheria procumbens*, and that its production is due to the action of a diastase on a glucoside. The presence of a soluble ferment and of a glucoside has been noticed in various plants. The fact that I have pointed out above with regard to the beech, and which has not been remarked before, rendered probable the existence of like substances in plants of this species. To verify this, it was indispensable to prove the existence of a glucoside and of a diastase, and to characterize the salicyclic acid.

To isolate the glucoside on one side and the soluble ferment on the other, I operated in the following manner:

I collected two lots of young beeches. For the first lot, I cut up without crushing, the hypocotyledonous axes in little pieces and placed them in concentrated alcohol of 95 deg., boiling. Every diastase susceptible of decomposing a glucoside was destroyed. The boiling was prolonged about twenty minutes; then the whole was kept for 24 hours at a temperature of about 50 deg. on the water bath. The alcohol was thus able to penetrate into the tissues and completely dissolve the glucoside. It was filtered and the liquid evaporated slowly at a temperature not passing 60 deg. Thus a syrupy glucoside, reddish brown, was obtained, which possessed no odor similar to that of wintergreen essence.

For the second lot, I triturated the hypocotyledons in alcohol of 15 deg. cold, and left them to macerate for some hours. I expressed the juice and submitted the residue to the same treatment twice again. All the glucoside was removed by the alcohol, and the diastase remained in the pulp obtained. This pulp exhales no characteristic odor. If, now, I dilute with a few drops of water a small quantity of the syrupy extract obtained with my first lot of plants, and if I add to it a slight quantity of the residue furnished by the second lot, I perceive immediately the characteristic odor of wintergreen essence; that is to say, of methyl-salicyclic ether. This mixture also contains glucose, for it reduces very actively the Fehling liquor.

There is now no doubt of the presence of a glucoside, which has been decomposed by a diastase. This glucoside is the same as that of the *Gaultheria procumbens*.

It is easy to reveal the existence of salicylic acid in the shoots of the beech crushed in water. In this state they were left to macerate for two or three hours; then a certain quantity of water was added and the whole distilled. The product obtained emits the odor of methyl-salicylate. To identify this product chemically, a few drops of soda lixivium were added to the distilled liquor, producing the saponification of the ether. If a complete saponification is desired, it is necessary to prolong the action for at least 24 hours, at a temperature of about 50 deg. Then there is added, drop by drop, sulphuric acid, to neutralize the soda and to render the liquid slightly acid. The salicylic acid being thus set free, a few cubic centimeters of this liquor were then treated with ferric perchloride. A beautiful violet color appeared.

On the other hand, the same liquor treated with ordinary ether, leaves to this ether all the salicylic acid. By slow and spontaneous evaporation of this dissolvent, the acid was obtained in the crystalline form. By dissolving in water a small quantity of these crystals and subjecting them to the action of ferric perchloride, the same violet color was produced.

The glucoside of the beech is formed at the beginning of the germination, for it does not exist in the seed, and it quickly disappears during the first year when the shoot has arrived at a certain stage of development. It is localized in the hypocotyledonous axes, with a little, also, at the top of the root. It does not exist in the cotyledons, or in the ordinary stems and leaves. It can now be said that the presence of this body characterizes the germinative period of the beech.

It is known that during the germination the nutritive substances of the cotyledons are communicated to the hypocotyledons, where they are transformed before serving in the development of the plant. It is also known that the ratio of the volume of carbonic acid emitted to the volume of oxygen absorbed is much lowered during germination; so that there is oxidation. These facts, in the particular case of the beech, seem in correlation on one hand with the localization of the glucoside in the hypocotyledons, on the other hand with the existence of this substance limited to the germinative period. In sum, the shoot of the beech contains a glucoside and a diastase which, under the action of water, gives birth to methyl-salicylic ether and to a glucose assimilated by the plant. This reaction, localized by the hypocotyledons, is produced neither in the seed nor in the mature plant.

The formation of methyl-salicylic ether is, therefore, characteristic of the germinative period of the beech.

* Paper presented to the Academie des Sciences.

FAST TRIP AROUND THE WORLD.

CHARLES C. FITZMORRIS, a boy who was sent around the world on a time race by The Chicago American newspaper, arrived in Chicago July 20, having made the tour in 60 days, 13 hours, 29 minutes and 42 4-5 seconds. The distance covered by land and sea was 20,455 miles. His route was by way of the Siberian railroad as far as completed and the Amur River. His record was as follows:

By water—	Miles.
Ocean steamers	8,640
Channel boats	235
River steamers	1,100
Rowboat	300
Tugboat	75
Ferryboats	40
Total	10,390
By railroads or land	10,055
Total	20,455

The Russian Minister of Railroads estimates that when the Siberian road is completed the whole trip can be made in thirty-three days, little more than half the present time, providing only that the fastest trains are taken and there is no missing of connections. His estimate of the stages of the journey is:

	Days.
St. Petersburg to Vladivostok	10
Vladivostok to San Francisco	10
San Francisco to New York	4½
New York to Bremen	7
Bremen to St. Petersburg	1½
Total	33

—Railway Review.

FLESH-EATING AND DECAYED TEETH.

OUR reluctance to become vegetarians may ultimately make us toothless, so we are warned by the editor of Modern Medicine. He says: "It has long been recognized by dentists that the use of flesh food is a prolific cause of decay of the teeth. Caries of the teeth is due to destruction of the teeth by the growth of microbes. These microbes require for their development the proteid substances which are found in meat or other animal substances. When flesh is used for food, the small fibers which become fixed between the teeth constitute the best possible culture-ground for teeth-destroying microbes. It is for this reason that dentists are so careful to instruct their patients to clean their teeth by drawing threads between them. Dr. Egbert, who has made a careful study of the teeth of the natives of India, in an article in The British Journal of Dental Science, states that although he has examined the teeth of hundreds of Hindu natives, he has never found a single case of malformation, and that the teeth of the Hindu people are remarkably free from decay. They rarely lose their teeth from caries. He attributed this remarkable immunity from a disease which is coming to be almost universal among Americans and English people, in part to the cleanly habits of the Hindus, who carefully cleanse their teeth with a primitive but efficient brush every day, not only as a matter of hygiene, but in obedience to the laws of their religion. He also calls attention to another and still more important factor—the absence of flesh food from the dietary of the Hindu. The rapid decay of teeth manifest among the people of the United States, which threatens to render us a toothless race within a century, is without doubt very largely due to the rapid growth of flesh eating in this country."

TRADE NOTES AND RECEIPTS.

Production of Powdered Sugar.—Vallez and Gèraud, of Montpelier, have invented a new process of producing powdered sugar direct from sugar solutions. The sugar solution is heated in a vessel with free admission of air, and after acquiring a temperature of about 120 deg. C. is passed into a stirring vat with shafts turning 30 to 40 times per minute. The water will immediately commence to evaporate and the strongly agitated mass finally becomes pulverulent. After about a quarter of an hour the whole process is terminated, whereupon the trough is tipped and emptied, the motion continuing, by means of a special contrivance. The advantages of the new process consist in that the production of the powdered sugar is accomplished by a single operation and the former operations of granulating and grinding are rendered unnecessary, thus avoiding all loss of sugar.—Neueste Erfindungen und Erfahrungen.

New Product of M. Lepine Called "Cerusine," Designed as a Substitute for Painting with Oil.—This new product is composed of animal glue, to which white lead, chalk, gum, resin, etc., have been added. The inventor has furnished us with a sample of the composition, and he states that in a kilogramme of animal glue proceeding from the waste of leather and various other materials, about two or three kilogrammes of white lead may be mixed. For the purpose of rendering the mixture siccative, there are added a less or greater proportion of borax and a small quantity of potash or nitric acid. Or, for one hundred kilogrammes of the product, composed of glue and white lead, there may be added 5 kilogrammes of borax, 500 grammes of aluminium sulphate and 500 grammes of potash, or a small quantity of nitric acid. The mixture is prepared cold. To obtain colors tinctorial products are made use of.—Translated from La Revue des Produits Chimiques.

Treatment of Furniture in Natural Oak.—In order to obtain for old German oak furniture the so-called antique tone, it is generally more or less stained; if this is not done, it can lay no claim to the attribute Old German. The modern method is more and more forcing its way, and the oak wood is allowed to retain its natural shade. It is a well-known fact that the large pores always look rather smeary, according to whether the workshop is more or less dusty. If this is to be avoided, which is essential for half-way neat work, take good wheat starch, pound it fine with a hammer and stir by means of a wooden spatula good strong polish with the wheat starch to a paste and work the paste into the pores by passing it crosswise over the wood. After about one-half hour, rub down the wood thus treated in such a manner that the pores are filled. In case any open pores remain, repeat the process as before. After that, rub down, polish or deaden. If this operation is not performed, the pores will always look somewhat dirty, despite all care. Every cabinet maker will readily perceive that this filling of the pores will save both time and polish in the subsequent polishing.— C. Ammon, in the Fachblatt fuer Holzbearbeitung.

Bronze Substitutes.*—The bronze colors which are extensively employed for bronzing articles of plaster and wood, as well as metal castings, and also in the manufacture of colored paper and wall paper, are known to be produced from the waste of metal-beating, by finely grinding and heating with a little oil, tallow, wax or paraffin. To find a cheap substitute for them has been the endeavor of many for years. Of late, a French patent giving the composition of such imitation bronzes has become known, whose preparation is given below. These products consist chiefly of powdered aluminium and a resin solution, to which certain pigments are added in certain quantities.

The following recipe is used in making imitation gold bronzes:

Sandarac	50
Mastic	10
Venice turpentine	5
Alcohol	135

In the above dissolve:

Metanil yellow and gold orange..... 0.4

and add

Aluminium, finely powdered..... 20 grammes

and shake.

If a deeper shade is desired, it is well to use ethyl orange and gold orange in the same proportion instead of the said dyestuffs.

For the production of imitation copper bronze, take the above-mentioned resin mixture and dissolve therein only gold orange 0.8 and add aluminium 20 grammes, whereby a handsome copper color is produced. Metanil yellow 0.4 gramme without gold orange gives with the same amount of lacquer a greenish tone of bronze. Further experiments have shown that the pigments must not be made use of in larger quantities, because the luster of the bronze would be materially affected. Furthermore a series of tests have demonstrated that only pigments of certain properties, such as solubility in alcohol, relative constancy to reductive agents, are suitable; unsuitable are, for instance: Naphthol yellow, phenylene-diamin, etc. Likewise only a lacquer of certain composition is fit for use, other lacquers of commerce, such as zapon (celluloid) lacquer being unsuitable.

The bronzes prepared in this manner excel in great luster and color effect. The cost is very low. They are suitable particularly for bronzing low-priced articles, such as tinware, toys, etc. Under the action of sun and moisture the articles lose some of their luster, but objects kept indoors, such as figures of plaster of Paris, inkstands, wooden boxes, etc., retain their brilliancy for years.—From the German of Dr. L. P. in Neueste Erfindungen und Erfahrungen.

* The term "bronze" is said to be an abbreviation of "aes Brundusinum," i. e. metal from Brundusium (now Brindisi.)

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

American Trade in Southern China.—There are no American merchants in Canton, and there is no record in this consulate of any having registered at the other treaty ports within this consular district. This and the general unbusinesslike methods which have obtained here for many years, make considerable work for a consul when he tries to prepare reports on existing trade conditions. The treaty ports (Canton, Swatow, Hoihow, Pakhoi, Wuchau, Samshui, and Macao) are, like the other districts of China, under the special supervision of the Chinese imperial customs, whose printed reports (emanating from the inspector-general of customs at Pekin, to whom they the transmitted from the customs commissioners at the various ports) are, as a rule, several months behind before being published. Their figures are reliable, but they lack the important details which tell merchants generally the market prices of the goods, etc., in the sale of which they are interested. The information accorded is so meager, so far as the purposes of traders are concerned, as to be to a certain extent valueless. The treaty ports are situated at considerable distances from each other. Between them, and at advantageous points for trading along the seacoast, are situated many flourishing towns like Fatshan, with populations ranging from 20,000 to over 500,000, in almost none of which has the American flag ever been seen. There is no fund available for the payment of a consul's expenses in traveling to and from those ports for such information relating to their commerce, industries, and resources as will enable him to prepare comprehensive and intelligent reports for the guidance and profit of intending exporters in the United States.

All the ports in Southern China ought to be as open as the treaty ports, for through them an extensive trade can be done with merchants and others in the interior and in places that are at present well-nigh inaccessible for all commercial purposes; and at each of these ports there is every reason why enterprising American merchants should have representative and branch houses. "Why are there no such men here?" is a question that, in view of the energy and grit of our business men, as well as of the remunerative returns that await properly conducted business enterprises in this section of China, often occurs to those who travel here for pleasure or otherwise. If it pays the British, French, Germans, and Dutch to establish firms here, with large capital, why should it not pay Americans? Those nationalities practically control the trade of the treaty and other ports, and it is through them that our large importing houses are supplied with silks, embroideries, blackwood furniture, mattings, teas, rattan, grass cloth, tiger and leopard skins, jade, etc., the value of which yearly foots up an enormous sum of money.

Inquiries are frequent from American manufacturers and business men generally as to the possibility of the sale of their respective products and wares, the prices likely to obtain here, and the names of responsible Chinese or other firms as prospective customers. These inquiries are usually accompanied by illustrated and descriptive brochures, sometimes by leaflets, and often by trade journals, in which the goods are generously and profusely advertised. Chinese merchants do not see those advertisements, pamphlets, etc., and if they did they could not read them or understand their purport. The only importers who can understand them are the British, the French, and Germans, who, naturally, give a decided preference to the goods consigned to them from their own countries, and will only accept American articles when their own cannot meet them in price, demand, ingenious workmanship, etc. Proper samples, however, tell their own story and help a consul wonderfully in pushing trade, or rather in creating a demand which in time may become remunerative. I am about to set aside a part of the consulate for the public exhibition of all samples forwarded to me. At present, the space which I will be able to give for that object will, necessarily, be limited; but I hope in the near future to have ample exhibition room to accommodate all consignments, as well as visitors—Chinese and others. Lowest prices C. O. D. at the treaty ports ought to be affixed to each commodity, and its accompanying "literature" should claim no other than its real uses and merits; for, although the Chinese are inveterate equivocators, they trust the word of a foreign merchant until he deceives them. It is, of course, to be distinctly understood that no sales will be made or effected by me under any circumstances, my desire and purpose being simply to show American products to Chinese and other traders, to make this section of Southern China a profitable market for American wares, and to bring American, European, and Chinese traders, mercants, and manufacturers into close business touch with each other.

This consular district comprises the provinces of Kwangtung, Kwangsi, and Yunnan, which cover a territory of 170,000 square miles, with a population of 80,000,000. The treaty and other ports to which I have referred are located in this district. The chief port is Canton, which has an estimated population of about 2,000,000, outside of considerably over 400,000 persons who live entirely on the sampans, lorchas, junks, flower boats, and other craft that throng the Pearl or Canton River. What will sell well or command a paying trade in Canton may fairly be relied on as sure of an equally good demand at any of the other ports, size of population and ease of access to the interior being taken into consideration.

All sorts of glassware for domestic, table, hotel, stationers', and other uses will find purchasers in Canton among the trading community if the prices quoted are low enough to tempt them to abandon the English, French, German, and Dutch products.

The Chinese have a liking for Americans and for American goods, but they cannot be relied on to become steady customers of the latter unless at the outset the articles sold to them are supplied at a very low rate and of a good quality. Intending exporters should bear these points in mind, remembering the while that after they have established a trade they can safely advance prices, so long as the articles supplied continue of good quality. A deterioration in quality is soon noticed, with the result of an immediate and permanent rupture of commercial relations. In other words, once the Chinese become accustomed to the purchase of any commodity or ware, they will acquiesce gracefully in its gradual increase in price, but will resent emphatically and for all time the attempt to palm off an inferior article upon them. If the manufacturer or exporter will treat his Chinese consignee with this consideration always in mind, he will benefit by it.

Stoves (oil, wood, and coal) and cooking ranges of American make are frequently asked for; also sewing and knitting machines, washing machines, and wringers.

American whiskies and American wines, champagnes, clarets, etc., are rarely seen here. Our distillers and wine growers and producers have apparently almost entirely forgotten this immense field. Scotch and Irish whiskies and French, German, Spanish, and Portuguese wines of all brands largely monopolize South China—certainly all the treaty ports.

Woven and barbed wire fencing, with substantial, yet artistically designed iron supports or pillars, will meet a moderate demand. With this commodity, as indeed, with very many others, a substantial measure of success could not reasonably be guaranteed or even expected at the outset. Many wares can be aided materially by a consul's good word, but their intrinsic merits will have to be depended on to win in the long run.

Sprayers, especially for garden and lawn uses, and lawn mowers may be placed in the same category.

Insect exterminators—if really "exterminators" and free from poisonous ingredients—if placed in good hands, will prove remunerative.

The trade in plain and fancy biscuits of all kinds seems, like that in other marketable articles, to be left very much to British and German producers, and will bear cultivation.

Perfumery and fancy soaps will always find a ready market, both among Europeans and the wealthy and middle class Chinese, the latter being particularly partial to perfumes.

Pure laundry soaps are certain of a ready sale throughout Southern China, and a good trade can be established if our manufacturers will sell at an exceptionally low rate and be content with a narrow margin of profit at the outset.

Watches and clocks with the latest improvements can always push themselves.

Our condensed milks, canned fruits and vegetables, tinned meats, soups, and sardines are already showing a disposition to shoulder their competitors to one side. All preserves, jam, jellies, pickles, and prunes should be sold in glass jars with hermetically sealed tops.

Cork insoles have yet to be noted in these markets.

Samples of recently approved medicinal preparations —remedies for complaints and ailments incidental to tropical countries—should find their way here, to the certain ultimate advantage of both the wholesale houses and the compounders.

In all of the seven treaty ports, there is not a cold-storage warehouse. Any business man can at once see the pecuniary possibilities in that direction.

The pianos and organs sold here are almost exclusively of English make, and the trade in them is held by two Hongkong firms, which do an excellent business in renting them out at $12 Mexican per month.

Porcelain and porcelain-lined bath tubs are rarities. The tubs in use are large, glazed earthenware bowls, with a capacity ranging from 8 to 12 and 14 gallons. The bather seats himself in the bottom of the bowl with his knees almost on a level with his chin, and in that uncomfortable attitude makes his ablutions.

Outside of the high-class hotels, water-closets with anything like proper appurtenances are unknown. Coolies remove the night soil every morning from the covered receptacles, in which it is allowed to accumulate usually for twenty-four hours. The exhalations are nauseating, and in a climate like this, where the plague, cholera, and smallpox abound, dangerous to life and health.

Turkish towels, Turkish rugs, bath mats, and Turkish bath robes, at moderately remunerative prices, should command a fair market.

Launches run by vapor, gasoline, or any motive power except steam or gas, safe, clean, economical, powerful, and easy to work, even by inexperienced Chinamen, will find in time a strong demand.

Prepared paints, guaranteed to last at least five years in a tropical climate without peeling, blistering, cracking, or chipping, are needed; so, also, are folding-top writing desks, with plenty of pigeon-holes, file boxes, capacious drawers, and the usual arm rests. In the same category are kitchen utensils of agate, nickel-steel, or enameled ware, warranted free from lead, antimony, arsenic, or other poisonous ingredient in the composition of the enamel.

Among the necessities are automatic water stills for distilling water for domestic use. There are no artesian or other wells, the water from the Canton River being used for all family purposes. As almost 500,000 Cantonese live on the sampans, junks, and house and flower boats on the Canton River—they are called "sea devils" by the Cantonese who live on land—it is obvious that the water taken from the river for drinking and household purposes must be impregnated with the germs of typhoid and other dangerous diseases. Hence the necessity for really good water stills, which ought to find a ready and profitable market.

Hair, husk and similar mattresses get lumpy and lose their shape after a short use in exceedingly hot and damp climates like those of Canton and the other treaty ports. Knitted or elastic felt mattresses that are non-absorbent, can be easily cleaned, afford little chance for vermin, and have the added merit of cheapness have not yet reached these markets.

Iron bedsteads fetch large prices. Small double ones, without any brass top ornaments and accompanied by a common woven-wire spring mattress, cost from $50 Mexican upward. In the United States, the same could easily be bought in retail stores for from $8 gold upward. Ordinary brass bedsteads with the same sort of common spring mattress sell for $150 Mexican and upward. Of course, it must be remembered that these beds are supplied with iron or brass rods at the tops, from which mosquito curtains or canopies depend—an essential in places where mosquitoes are as numerous and vicious as here.

Hair and clothes brushes are in demand, as are also good refrigerators especially suitable for the tropics, well equipped with shelves and arranged so as to keep the meats, fruits, etc., fresh and sweet smelling; supplied with water trap to catch waste water; easy to keep clean, and economical in amount of ice used. Refrigerators that become moldy or musty after short use should not be shipped here, because they will destroy the market for the superior article.—Robert M. McWade, Consul at Canton.

American Coal in Europe.—The Department has received from Mr. Thieriot, chargé d'affaires, of Lisbon, under date of June 26, 1901, translation of an article on American coal, published in the Lisbon Jornal do Commercio which reads, in part, as follows:

The announcement is made by cable that a trust has been formed in the United States for the exportation of coal to the Mediterranean ports to compete with English coal, which the recent export duty of 1s. (24.33 cents) per ton will raise in price. This competition would be easier than on the Atlantic ports; for, if the freight from Philadelphia to Marseilles, for instance, is 24 to 36 cents higher than the freight from Philadelphia to Havre, it must not be forgotten that the freight from Cardiff to Marseilles is 77 or 97 cents higher than from Cardiff to Havre. Vessels taking from sixteen to seventeen days to cross the Atlantic to Havre would take nineteen to twenty days to Marseilles, a difference in time of three days. On the other hand, vessels taking thirty-six to forty-eight hours to go from Cardiff to Havre would take ten days to reach Marseilles, a difference of seven to eight days. At the close of 1898, and during 1899, the Paris, Lyons and Mediterranean Railway purchased about 100,000 tons of American coal. There has been a decline in the price of English coal since 1900, making a difference in favor of English coal. It is announced that vessels of 10,000, 20,000, and even 30,000 tons will be built which will carry at the extraordinary low freight of $1.16 per ton across the Atlantic. It would seem to be more prudent to begin with smaller vessels, having first ascertained the capabilities and requirements of the ports for which they are bound.

Paraguay Export Company.—Consul Ruffin reports from Asuncion, May 18, 1901, that the importers and exporters of that city have formed a company to control the exports of Paraguay. The company will make advances to producers, receive products in consignment for export on commission, and transact such business as may in the opinion of the board further the interest of the company. In view of the generally prosperous conditions and the fact that no failures have taken place for the last few years, business men in the country seem disposed to invest capital; and there is every hope, says the consul, that Paraguay will take advantage of her improving credit in foreign markets and extend her commercial relations.

An International Exposition of Agricultural Machinery.—Under date of July 20, 1901, Consul Haynes, of Rouen, writes as follows:

An international exposition of agricultural machinery will open at Lodi, Italy, in September, 1901. It will include farming implements, machines for the making of butter and cheese, the secondary products of milk, automatons, and automobiles. In order to save time, it would be well for persons interested to secure information as to exhibits, etc., from the Italian Chamber of Commerce, Paris, rather than from Lodi. The address is La Chambre de Commerce Italienne, 17 boulevard de la Madeleine, Paris.

Proposed Exposition at Cork.—Under date of June 29, 1901, Consul Swiney, of Cork, informs the Department that an exposition of the products and industries of Ireland will be held at that city in 1902. The site selected is on the banks of the River Lee. The people of Dublin, Belfast, and other cities of Ireland have promised their support and have already liberally contributed toward the erection of the buildings and the preparation of the grounds. The railroads have also subscribed, and, in addition, will make low rates to visitors. The Consul adds that a number of the exhibitors at the Glasgow exposition will bring their exhibits to Cork.

Decline in Price of Rusian Petroleum.—The following, dated June 18, 1901, has been received from Consul Mahlin, of Reichenberg:

The price of petroleum, which last year materially advanced, is now steadily declining in this part of the world. In the Russian oil district, the decline is remarkable, amounting to fully 50 per cent at Baku since January. This is due to increased production (amounting to about 25 per cent in comparison with the early months of 1900) and to the large accumulation of reserve stock. The reserve at Baku is now said to be about 200,000,000 poods (about 7,222,000,000 pounds). In Russian petroleum circles, the blame for this vast accumulation is laid to the inadequate transportation facilities of the Trans-Caucasian Railway.

The declining quotations from New York are construed as indicating that the weakness of the Russian petroleum market is having a far-reaching influence.

INDEX TO ADVANCE SHEETS OF CONSULAR REPORTS.

No. 1117. August 19.—Trade Conditions in South Africa.

No. 1118. August 20.—* Ice in France.

No. 1119. August 21.—Mining in Ontario.—Quinine Auction Sale at Batavia.—Cognac Industry of Malaga.—Business Directory of Monterey.—German Money in Samoa.

No. 1120. August 22.—The Proposed New German Tariff.—The Harbor of Emden.

No. 1121. August 23.—* Electrical Developments in Greece.—* American Coal Holster at Alexandria.—* Provincial Exposition at Malaga.—* French School in Greece.

No. 1122. August 24.—German Metal Exports and Imports in 1901.—Antwerp Ivory Market.—* Extinguishing Fire in Rouen.—Belgian Demand for Hydrosilicate of Aluminium and Magnesium.

The Reports marked with an asterisk (*) will be published in the SCIENTIFIC AMERICAN SUPPLEMENT. Interested parties can obtain the other Reports by application to Bureau of Foreign Commerce, Department of State, Washington, D. C., and we suggest immediate application before the supply is exhausted.

SELECTED FORMULÆ.

GOLD ENAMEL PAINTS.

There are quite a variety of mixings for these metallic "bronze" or "gold" paints. The first of its kind was considered to have been originated by the late Sir H. Bessemer, who used to make it under lock and key, as at that time it was looked upon as a great secret. He is supposed to have netted a lot of money by its manufacture and sale, and was thereby probably enabled to proceed with other inventions destined to be great and in their effect revolutionary. Prior to the introduction of this Bessemer paint, gold-leaf only had been used, and in consequence thereof the article was dear. The renowned inventor appears to have early discovered that which is troubling many at the present time—e. g., the "greening" of the vehicle, which is very objectionable and unsightly.

It is set up by free acid in the medium, and as these bronzes are very readily attacked by acids, this is the reason of this greenish appearance developing, as chemical reaction takes place. It may be overcome by neutralizing any acid in the liquid used as a binder by the addition of lime, etc., as in the Bessemer paint, for which the recipe following is a modern formula, yet little different from the original:

1.	Pure turps	6	pints
	Copal varnish	1	pint
	Good gold bronze	6½	pounds
	Calcis hydrate (dry-slaked lime)	½	ounce

Method.—Mix the varnish and turps at a gentle heat, then slake well with the lime, and settle for a few days, then pour off the clean portion and mix with the powder.

We cannot say who now makes the article, but in chemists' lists one may find Bessemer paint enumerated, but perhaps the name is used only, and in reality has no particular meaning.

2.	White hard varnish	1	gallon
	Methylated spirit	¾	gallon
	Gold bronze	12	pounds
	Finely powdered mica	3	ounces

Method.—Mix the varnish and the spirit, reduce the mica to an impalpable powder, mix with the gold, then add to the liquid. Many bronze powders contain a goodly proportion of mica, as it imparts brilliancy. Powdered mother-o'-pearl is used also.

3.	Benzole	5	gallons
	White hard varnish	1	gallon
	Sheet guttapercha	2	pounds
	Bronze powder	34	pounds

Method.—Finely shred the guttapercha and dissolve in the benzole, then mix with the others. A very good bronze may be obtained for fifteen pence a pound now.

4.	Amylic alcohol	1	gallon
	Amyl acetate	1	gallon
	Gold bronze	10	pounds
	Celluloid chips	9	ounces
	Camphor	4	ounces

Method.—Mix the liquids and add camphor and celluloid, and allow to dissolve, frequently shaking to assist, then settle for several weeks, pour off the clear portion, and add the bronze.

5.	Sulphuric ether	1	gallon
	Acetone	½	gallon
	Fusel oil	½	gallon
	Bronze powder	14	pounds
	Pyroxilin	8	ounces
	Castor oil	2	ounces
	Canada balsam	1½	ounce

Method.—Mix ether, acetone and fusel oil, and therein dissolve the guncotton, then strain, and add the others.

This is one of those very quick-drying paints, and is elastic and washable.

6.	Amyl acetate	39	pounds
	Bronze powder	30	pounds
	Acetone	10	pounds
	Transparent celluloid chips	1	pound

Method.—Pour the acetone over the celluloid in a covered jar or bottle, stirring often, and when the whole has softened into a viscid transparent jelly, thin out with the acetate of amyl and add the powder.

Camphor added in small proportion to methylated spirit will dissolve celluloid fairly quickly, to make a gold paint fluid, but this is not so good as the above. Naturally other colored bronzes may be substituted for the golden one, or pretty effects are got by staining a gold paint with aniline as required.

CASHMERE PERFUME.

Essence violet	120 ounces
Essence rose	180 ounces
Tincture benjamin (1 in 4)	60 ounces
Tincture civet (1 in 62)	30 ounces
Tincture Tonka (1 in 4)	30 ounces
Oil patchouli	3 ounces
Oil sandalwood	6 ounces
Rose water	60 ounces

—Oils, Colours and Drysalteries.

Preservative for White Paste.—Various antiseptics are employed for the preservation of flour paste, mucilage, etc. Boric and salicylic acids, oil of cloves, oil of sassafras and solution of formaldehyde are among those which have given best service. We append Remington's formula for a flour paste which may be kept for a long time without deterioration:

Flour (wheat)	
Water	16 fluid ounces
Nitric acid	1 fluid drachm
Oil of cloves	5 minims
Boric acid	10 grains

Thoroughly mix the flour, boric acid and water, and strain the mixture through a sieve; add the nitric acid; apply heat, with constant stirring, until the mixture has thickened; when nearly cold add the oil; strain the mixture through a coarse muslin, if not perfectly smooth. This paste keeps well, and is much superior to tragacanth mucilage and ordinary paste. When it is required for pasting labels on tinned surfaces, the addition of 10 per cent of glycerin will prevent the labels from falling off after drying.—Pharmaceutical Era.

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TABLE OF CONTENTS.

PAGE

I. AERONAUTICS.—Test of Balloon Motors.—1 illustration 21475

II. ARCHITECTURE.—St. Paul's 21468

III. AUTOMOBILES.—Automobile Opportunity in France 21475

IV. CEMENTS.—Cements.—By WILLETT C. PEARSON 21468

V. CHEMISTRY.—Glucoside Characterizing the Germinative Period of the Beech.—By M. P. TAILLEUR 21469

VI. CIVIL ENGINEERING.—Seoul-Fusan Railway 21475

VII. COMMERCE.—Trade Suggestions from United States Consuls 21468

VIII. ENTOMOLOGY.—Smyrna Fig Culture in the United States.—By L. O. HOWARD.—6 illustrations 21470

IX. FUELS.—Mond Gas 21468

X.—GEOLOGY.—Fossils and their Teachings 21472

XI. MARINE ENGINEERING.—The Welin Boat Lowering Gear.—9 illustrations 21474
Shipbuilding in the United States 21476

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Flesh-Eating and Decayed Teeth 21468

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Selected Formulæ 21466
Trade Notes and Receipts 21464

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